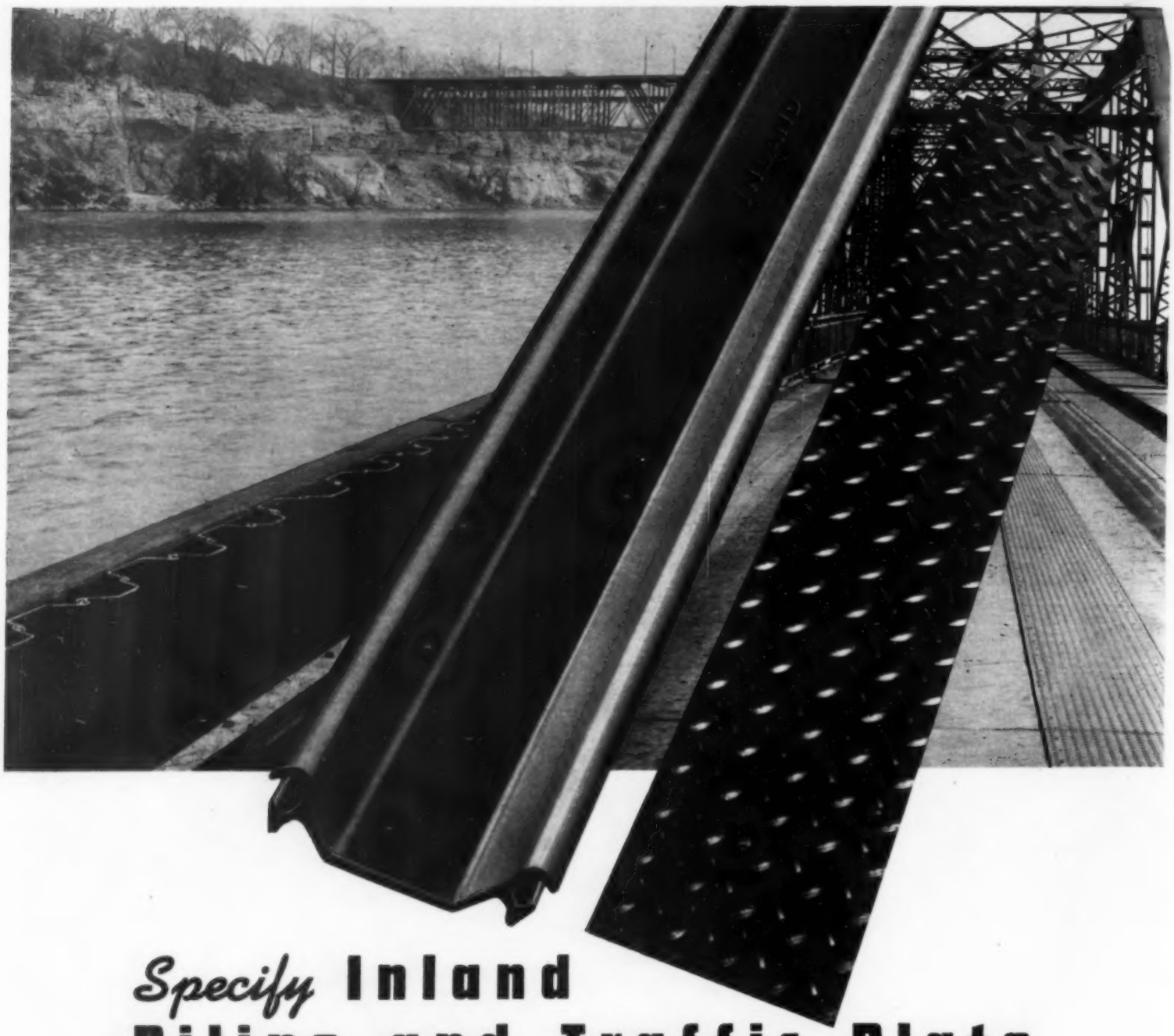
Construction Methods and Equipment

McGraw-Hill Publishing Company, Inc.

December, 1937

Price 20 Cents

WOODEN ARCH TRUSSES for buildings of 1939 Golden Gate International Exposition, at San Francisco, are raised by specially designed tackle that equalizes erection stresses.



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Inland Steel Piling (write for Inland's new piling catalog). With its more than 70,000 lbs. per sq. in. tensile strength, and remarkable resistance against corrosion, you'll find it guarding shorelines and the banks of raging rivers against destructive washouts and floods . . . or used and re-used many times in cofferdams during important construction projects.

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CURRENT JOBS

. . . . and Who's Doing Them

Construction
Methods and Equipment

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WILLARD CHEVALIER, Vice-President

DECEMBER, 1937

The "How" of it

For the benefit of readers concerned with the practical application of method or equipment the following references are to articles or illustrations in this issue that tell:

●

How STEEL SHEETPILE COFFERDAM withstood flood. — p. 37

How UNIFIED ORGANIZATION of 600 men built 85 houses on 37-acre plot. — p. 40

How MECHANICAL BACKFILLER covered pipe laid in trench excavated by ladder-type ditcher. — p. 40

How MOBILE HORIZONTAL CONVEYOR, on steel rails, distributed concrete from mixer to forms. — p. 40

How STEEL WINDOW FRAMES were set and anchored in advance of masonry wall construction. — p. 40

How PLANK SCAFFOLD, supported by two ladders, provided working platform for painters. — p. 42

How SPECIAL TACKLE equalized strain in raising heavy wood arch roof trusses. — p. 44

How CIRCULAR TEMPLET of steel pipe, 47½ ft. in diameter aided setting of sheet piles for cofferdam. — p. 45

How COLD WEATHER CONCRETING can be carried on with improved methods and equipment. — p. 46

How SALAMANDERS should be spaced for effective heating of building construction. — p. 47

How PIPE COILS were set over fire to heat concrete mixing water. — p. 47

How JACKING forced 96-in. corrugated metal pipe under railroad tracks. — p. 50

How THREE-AXLE TANDEM ROLLER weighing 13½ tons, compacted asphaltic mix. — p. 51

How ROAD SHOULDERS were finished by blade trailer hooked to truck. — p. 52

How HOMEMADE TONGS handled heavy rocks. — p. 52

How BRACING was set to hold bulkhead forms for concrete lock. — p. 53

How POLE TRESTLE was rigged to carry concrete carts. — p. 53

How BANK GRADING was done by clamshell crane on barge. — p. 53

How PNEUMATIC-TIRED WAGONS moved material for earth fill dam. — p. 54

How WOOD TEMPLET guided concrete finishers on ogee section of weir. — p. 56

How TRIMMING MACHINE shaped canal section. — p. 58

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How TUNNEL LINING was placed by special equipment. — p. 62

How COLLAPSIBLE FORMS of wood were used ten times on small tunnels. — p. 63

How H-COLUMNS were driven in river bed to support low-cost bridge. — p. 64

ROBERT K. TOMLIN, Editor — A. E. PAXTON, Manager

Editorial Staff: Vincent B. Smith, John B. Huttl (San Francisco), Paul Wooton (Washington), Nelle Fitzgerald

NEXT MONTH — *Annual Road Builders' Number*

The January, 1938, issue of CONSTRUCTION *Methods and Equipment* will be the Annual Road Builders' Number appearing on the eve of the Convention and Road Show at Cleveland, Ohio, Jan. 17-21, of the American Road Builders' Association. It will feature new developments in method and equipment for highway construction.

WATERWORKS

Outstanding projects awarded last month included three big shaft and tunnel contracts for New York City's additional water supply from the Delaware River, totaling approximately $34,000,000 as follows: **G. H. Flinn Corp.**, New York City, $11,996,145 for two shafts and 33,400 ft. of tunnel; **Siems-Helmers, Inc., Johnson, Drake & Piper** and **Leo Butler Bros. Co.**, Freeport, N. Y. $10,961,765, for two shafts and 33,600 ft. of tunnel; **S. A. Healy Co.**, of Chicago, $10,985,695, for two shafts and 37,000 ft. of tunnel.

In Corpus Christi, Tex., $619,964 contract went to **Brown & Root**, of Corpus Christi, for 16-mi. water main. Pipe lines in San Francisco were awarded to **Macco-Robertson, Ltd.**, of Clearwater, Calif., for $213,620 and to **Williams Bros. & Haas**, of San Francisco, for $214,820.

SEWERS

A $1,191,135 storm sewer contract in Long Island City, N. Y., was awarded to **Elmhurst Contracting Co.**, of Elmhurst, N. Y. Also, in Long Island City, **Tully & DiNapoli**, received a $1,110,750 trunk sewer job. Another sewer contract for $673,875 went to **Nicholas Di Menna & Son**, of New York. In Charlotte, N. C., **Southeastern Construction Co.** of Charlotte, is building a $337,994 sewage plant. Sewer contract in Chicago, Ill., went to **Michael Pontarelli, Inc.**, of Chicago, for $1,398,571. In Buffalo, N. Y., **Couse & Saunders Engineering Co.**, of Detroit, is constructing buildings and tunnel for sewer project.

WATERWAYS

For deepening Oswego canal in New York State, bid of $2,593,850 was submitted by **Dunbar & Sullivan Co.**, of Detroit. Bid of $846,800 for excavating in New York Barge canal, was received from **Gahagan Construction Corp.**, of Brooklyn, N. Y. **Woods Bros. Construction Co.**, of Lincoln, Neb., obtained a $251,254 contract for Mississippi River bank protection near St. Louis, Mo.

BUILDINGS

Public — At Harrisburg, Pa., contract for state finance building was awarded to **McCloskey & Co.**, of Philadelphia, for $3,112,000. Hospital at St. Thomas, Ontario, Canada, to cost $3,500,000 went to **Pigott Construction Co.**, of Hamilton. **Matthew Cummings Co.**, of Boston, Mass., was low bidder at $1,327,526, for hospital-ward building at Torrance, Pa. Public school in Brooklyn, N. Y., is being built by **D. M. W. Contracting Co.**, of Brooklyn, for $569,000. State office building for Oklahoma City, Okla., costing $529,000, is under construction by **W. S. Bellows Co.**, of Oklahoma City.

Commercial — At Teaneck, N. J., **L. Gold**, of New York, is constructing 210 houses to cost $2,310,000. A million dollar apartment house in New York City is under construction by **Simons Bros.**, of New York. In Los Angeles, **The Austin Co.**, of Los Angeles, was awarded a million dollar broadcasting studio contract by The National Broadcasting Company. Mass housing, comprising 200 residences on a 40-acre tract in Albany, N. Y., is under way at cost of $1,500,000, by **Wilson Sullivan Co., Inc.**, of Albany. In Montclair, N. J., a development consisting of 100 homes to cost $1,250,000, has been started by **Montclair Modern Homes, Inc.** Another development of 119 homes to cost $800,000, has been started at Livingston, N. J., by **L. C. Larsen.** General contract at Pittsburgh, Pa., for a hospital group was awarded to **Stone & Webster**, of Pittsburgh, for $750,000; foundation contract on foregoing job went to **D. T. Riffle**, of Pittsburgh. **L. E. Dixon**, of Los Angeles, received a $500,000 contract for 6-story dry goods store in that city.

Industrial—Substructure contract for new Ford shop at River Rouge, Mich., to cost $1,500,000, went to **Western Foundation Co.**, of Chicago. For Eastman Kodak Co., at Rochester, N. Y., **Ridge Construction Corp.**, of Rochester, is building a $500,000 plant building. Successful bidder on an industrial building costing $500,000, at Maspeth, N. Y., was **H. Rosen**, of Brooklyn, N. Y. Power house for General Motors Corp., at Clark, N. J., was bid in for $450,000 by **Andrew Christensen**, of Elizabeth, N. J.

MISCELLANEOUS

Dock improvements for Pennsylvania R. R. Co., at Sandusky, Ohio, to cost $4,000,000, will be made by **Great Lakes Dredge & Dock Co.**, of Chicago. For approaches to Lincoln tunnel, between New York and New Jersey, contract was let to **B. Perini & Sons**, of Framingham, Mass., for $773,273. An airport hangar at Baltimore, Md., went to **Kaufman Construction Co.**, of Philadelphia, for $240,000.

HIGHWAYS

Highway contracts were awarded in the following states: Texas, $200,071 and $255,132 to **Harrison Engineering & Construction Corp.**, of Kansas City, Mo. Mississippi, $272,046 to **Woodrich Construction Co.**, of Minneapolis. Pennsylvania, $258,531 to **D. W. Challis & Sons**, of Sewickley, Pa. New Jersey, $301,892 to **Highway Corporation**, of Newark, N. J. Minnesota, $254,351 to **A. Guthrie & Co.**, of St. Paul. California, $226,636 to **Hemstreet & Bell**, of Marysville, Calif. Alabama, $217,000 to **H. E. Wolfe Construction Co.**, of St. Augustine, Fla.

BRIDGES

Contract for constructing Calvin Coolidge Memorial bridge over Connecticut River at Northampton, Mass., was awarded to **T. Stuart & Son Co.**, of Watertown, Mass., for $1,193,231.

Good Will Toward Men

THROUGHOUT THE AGES men of every race and creed have set up and worshipped their gods of good will. Born into a world of natural terrors, the earliest men sought in fellowship a refuge from their common fears. From this crude instinct of mutual dependence have been refined the virtues that we know as forbearance, good will and friendship.

Today man has all but conquered his dread of the natural world. The powers that terrified his infancy he has harnessed to his service. Here and there a few dark corners linger to frighten him. Now and then rampant nature spurns his yoke and mocks his mastery. But the old terrors have been laid.

But through his very conquest, man has raised up new dreads. No longer afraid of his world, he now fears his fellow-men. Under that fear he suffers himself to be herded, singly, by class and by nation, into the dismal sloughs of intolerance, suspicion and distrust. New terrors have possessed him.

Never has man needed more desperately those virtues of mutual dependence which, in his arrogance, he feels he has outgrown. Never has his progress, yes, even his survival, been more dependent on his practical fidelity to the spirit of the first Christmas: On Earth Peace, Good Will toward Men. By that spirit alone can man conquer his new terrors.

And in that spirit we lay aside for this issue all matters of routine and material interest, so that we may offer to each reader in whatever clime and of whatever race or creed, the human fellowship of our staff, together with their bountiful wishes for all the well-being and happiness that is implicit in the greeting

*** Merry Christmas ***

Willard Chevalier

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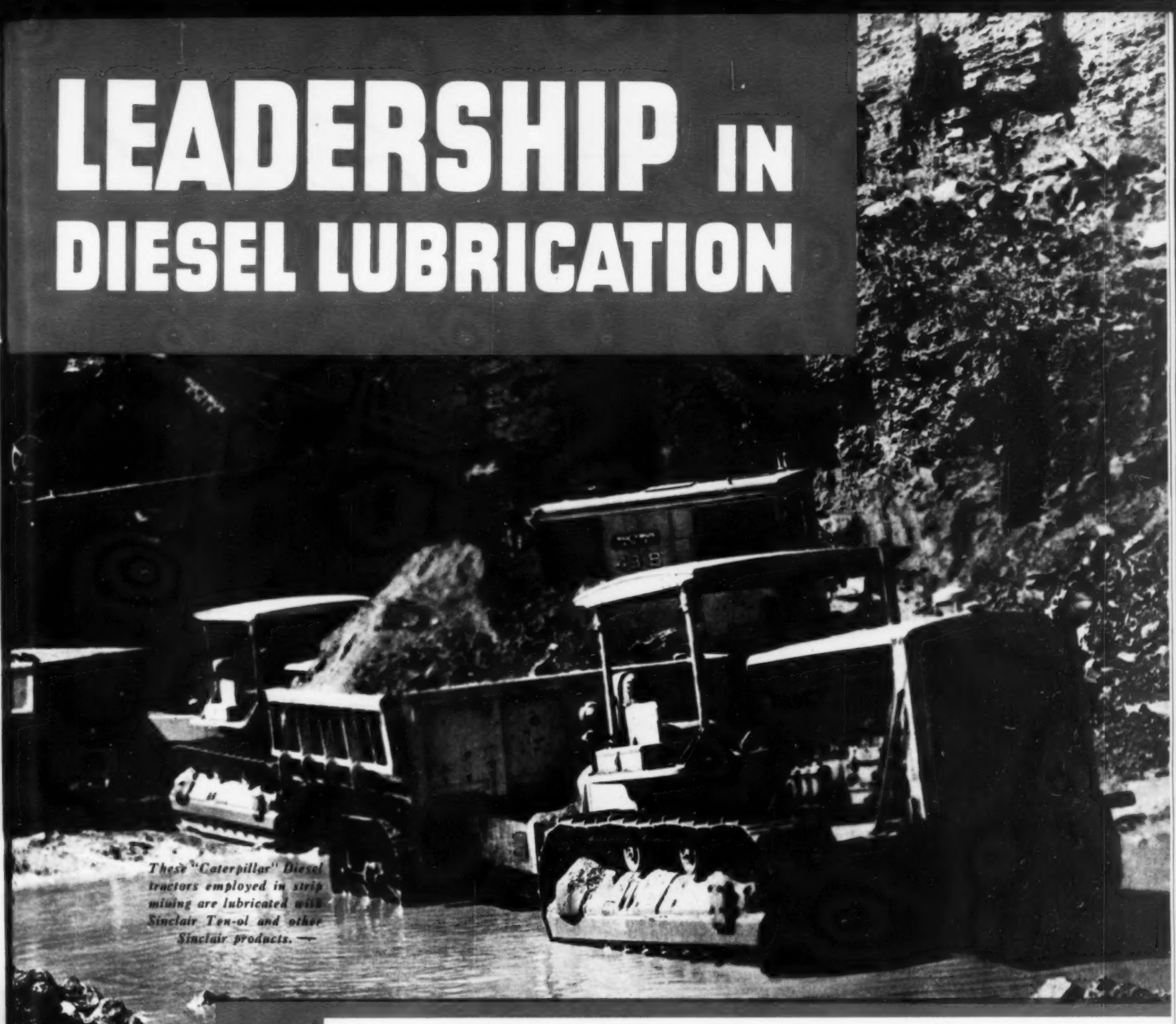
LEADERSHIP IN DIESEL LUBRICATION



These "Caterpillar" Diesel tractors employed in strip mining are lubricated with Sinclair Ten-ol and other Sinclair products.

SINCLAIR TEN-OL

REG. U. S. PAT. OFF.

Less than a year ago Sinclair introduced Ten-ol, a lubricant as rugged in service performance as the "Caterpillar" Diesel engines for which it was developed.

Wide acceptance put Ten-ol to the most convincing of tests—showdown of performance under the toughest operating conditions. For example, in mining and quarrying... in road building ...on public projects.

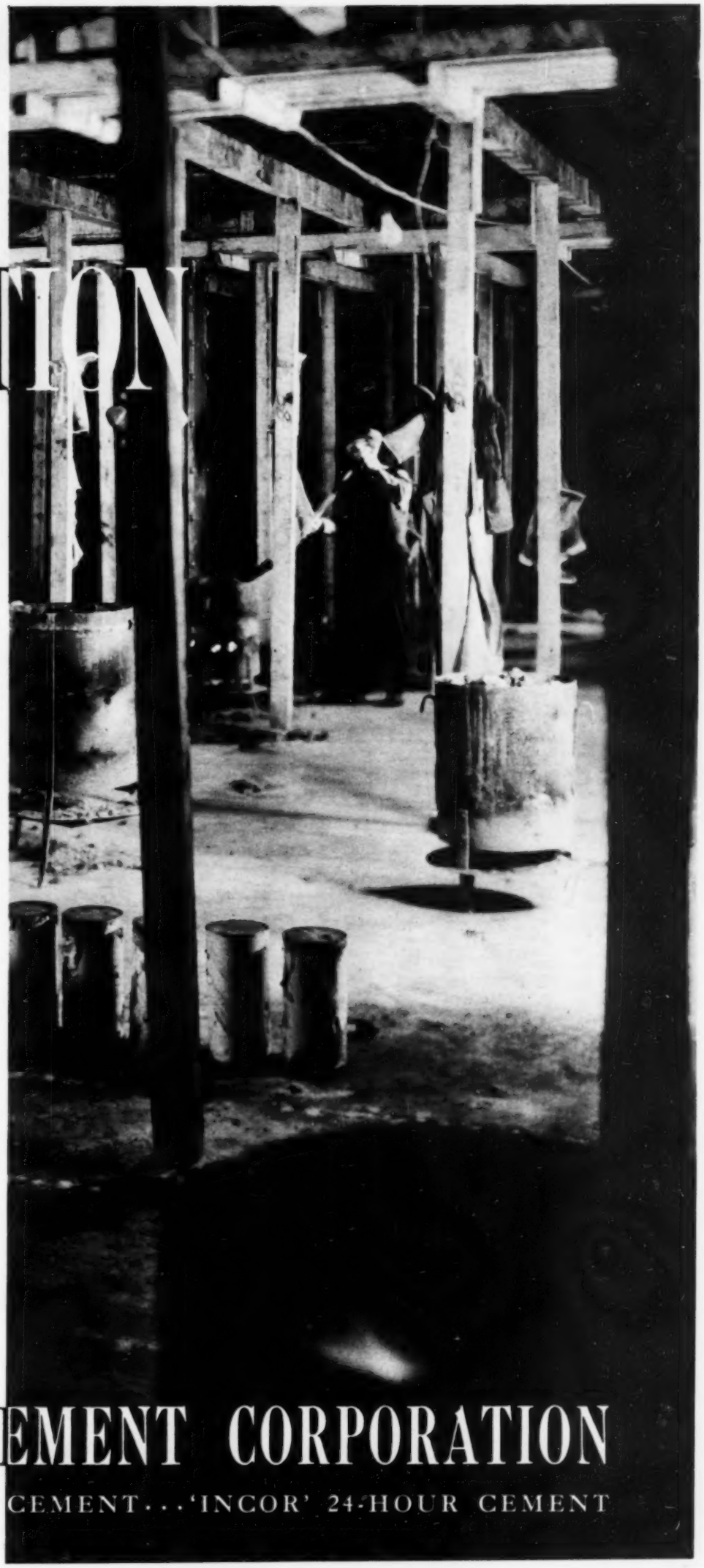
"Caterpillar" Diesel operators find Ten-ol increasing service hours, giving sustained top-notch engine performance, and providing full lubricating protection under emergency overloads. That's why it is recommended as a "new, outstanding Diesel engine lubricant" by Caterpillar Tractor Co.

Try Sinclair Ten-ol and Sinclair Diesel fuel. Order them and other Sinclair products from your local Sinclair office, or write Sinclair Refining Company (Inc.), 630 Fifth Avenue, New York, N. Y.

SINCLAIR TEN-OL

is recommended as a "new outstanding Diesel engine lubricant" by Caterpillar Tractor Co.

'INCOR' CUTS HEAT-PROTECTION COSTS



THE quicker concrete hardens, the less time and expense are required to provide heat. That is why 'Incor' 24-Hour Cement can save you real money on work now in progress or about to start.

'Incor' cures or hardens in one-fifth the usual time. Concrete is safe from freezing days sooner. With 'Incor', you simply heat mixing water and aggregates, and provide heat-protection for 24 hours after concrete is placed. That saves two days' heat-curing.

Following example illustrates this heat-protection saving—one of several ways 'Incor'* reduces costs:

6-story-and-roof concrete-frame building—
100' x 100' in plan
To provide heat, 30 salamanders per floor

Operating Costs:
Coke, 5 tons a day, at $10.....$50 per day
Labor, 4 men tending fires, at $5...$20 per day
Heat cost.....$70 per day

'Incor' Saves:
2 days' heating expense per floor...$140
For 6 stories and roof.....$980

These fuel and labor savings are usually accompanied by reduced form costs, and by faster erection time, which means lower job overhead as well.

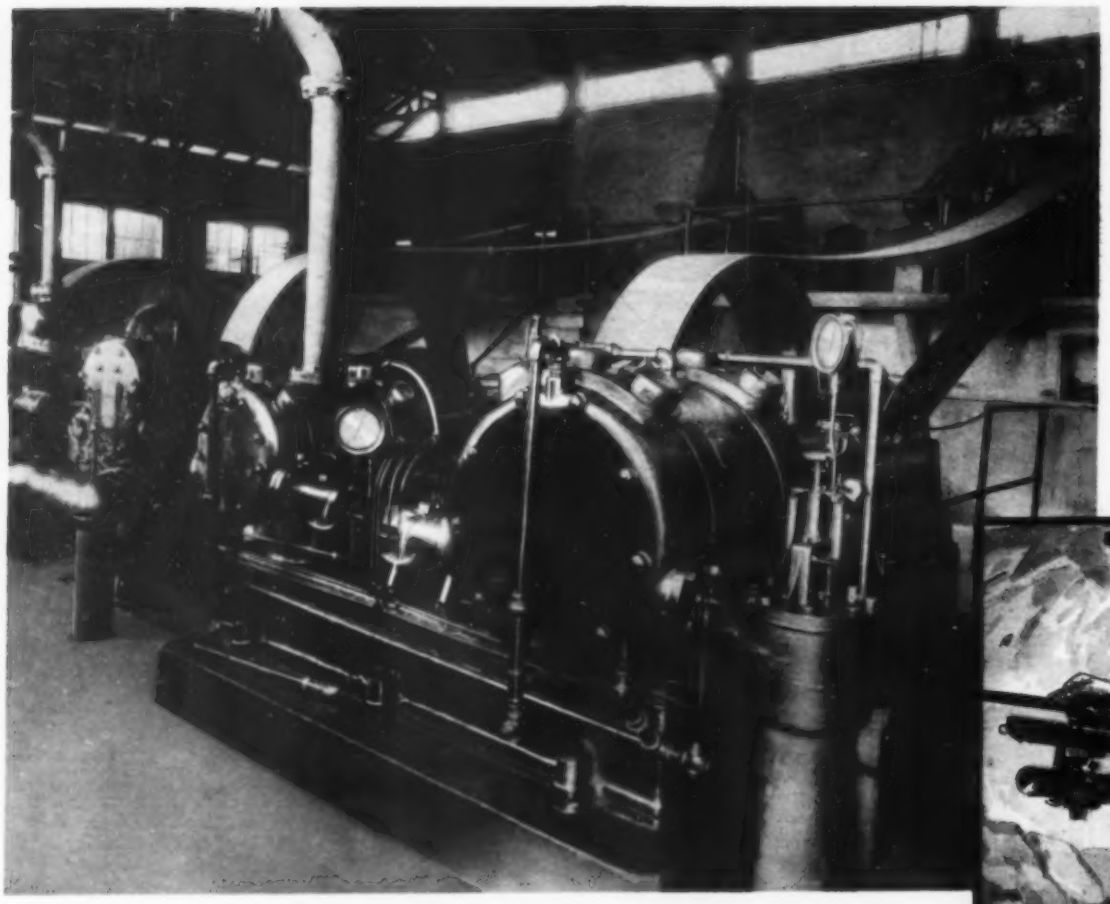
Savings like these are too important to overlook. Figure them on work now in progress. Write for copy of "Winter Construction." Lone Star Cement Corporation, Room 2292, 342 Madison Ave., New York. *Reg. U. S. Pat. Off.

LONE STAR CEMENT CORPORATION

MAKERS OF LONE STAR CEMENT...'INCOR' 24-HOUR CEMENT

IN THE FAMOUS

Mother Lode...



View of compressors at the Argonaut Mine. Texaco Alcaid keeps rings free, valves properly seating, the whole compressor clean.

AIR TOOLS—*You can be sure of a big day's work . . . every day . . . for each drill, when it's on Texaco. And this is all anyone can expect of his drills. Above all, don't attempt to save money on air tool lubricants . . . you'll end by having to spend several times more on repairs than your "savings."*

"The Argonaut Mine at Jackson, Amador County, is situated in the heart of the famous Mother Lode of California. This gold mine is mining ore from the 6,000 foot level where some of the working faces are approximately 1½ miles from the compressors. The compressors supplying the compressed air are lubricated with Texaco Alcaid Compressor Oil."

The above is from a letter written by Alex F. Ross, Superintendent. From experience, Mr. Ross knows that Texaco compressor oils can be counted upon to give him long, continuous service. He knows that they keep his compressors *clean,* free from gumming and the consequent ring sticking with which he formerly was faced.

Trained lubrication engineers are available for consultation on the selection and application of Texaco Compressor and Air Tool Lubricants. Prompt deliveries assured through 2070 warehouse plants throughout the United States. The Texas Company, 135 East 42nd Street, New York City.

TEXACO

TEXACO COMPRESSOR & AIR TOOL LUBRICANTS

Get acquainted with these Northwest features at the ROAD SHOW—

CLEVELAND
Jan. 17-21
6 acres of Equipment
NEW MACHINES, MATERIALS, METHODS

MACHINERY that was profitable for you yesterday may lose money on your job tomorrow. You can't afford to let unfamiliarity with improvements in construction and design be the cause of future profit losses. Keep up with the times—come to the Road Show and see these improvements for yourself.

Here you will see all the leading road machinery on exhibit. You can investigate and compare every detail. Come to Cleveland. It will be money well spent.

NORTHWEST ENGINEERING CO.
1727 Steger Bldg., 28 E. Jackson Blvd.
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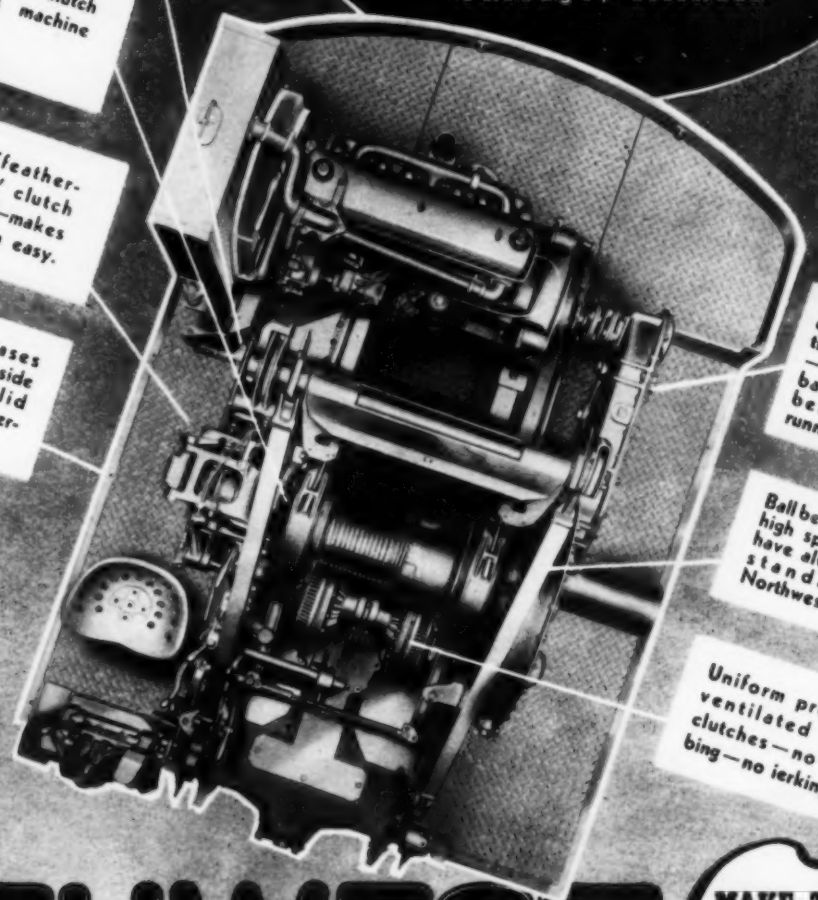
The worm boom hoist—under power up or down—smooth—chatter-free.

The cushion clutch increases machine life.

The "feather-touch" clutch control—makes operation easy.

Cast steel bases with cast steel side frames—a solid backbone for operating machinery.



Helical gear drive—the silent, trouble-free drive—mounted on ball and roller bearings and running in oil.

Ball bearings on all high speed shafts have always been standard on Northwests.

Uniform pressure, ventilated swing clutches—no grabbing—no jerking.

NORTHWEST

MAKE THE NORTHWEST BOOTH YOUR HEADQUARTERS

"FAN MAIL"

from "Caterpillar" Diesel Operators Everywhere!

CALIFORNIA

"Been using 'RPM' Diesel Engine Lubricating Oil in three 'Caterpillar' Diesels for six months . . . over 3,000 hours each. No increase in consumption . . . no loss of time . . . efficiency of 'RPM' *will cut my operating costs in half!*"

E. C. Salyer, Farming Contractor
Corcoran, California

IDAHO

"Am operating 60 hours between drains and the oil is as good as when first put in—also oil pressure is the same at all times, which shows that the motor is getting perfect lubrication."

W. S. Clyde
Moscow, Idaho

CANADA

"We recommend 'RPM' Diesel Engine Lubricating Oil to all our 'Caterpillar' Diesel operators. . . . The result has been very satisfactory for them and for ourselves as distributors."

R. D. Rowell
Powell Equipment Company, Ltd.
Winnipeg, Canada

WASHINGTON

"'RPM' Diesel Engine Lubricating Oil loosened and cleaned out old carbon . . . and we are now pulling the same load at one notch lower on the throttle."

Hemphill Diesel Schools
Seattle, Washington

TENNESSEE

"'RPM' Diesel Engine Lubricating Oil has relieved us of considerable expense and at the same time has added many hours of engine life to 'Caterpillar' Diesel Engines!"

John Fabick, Jr.
Fabick Tractor Co.,
Memphis, Tennessee

VIRGINIA

"From the standpoint of performance and reduction in service costs, 'RPM' Diesel Engine Lubricating Oil is superior to anything we have been able to use in 'Caterpillar' Diesels."

R. H. Carter
Virginia Tractor Co., Inc.
Richmond, Virginia

PROOF

that you can get better performance and cut costs with

"RPM" DIESEL ENGINE LUBRICATING OIL

ALASKA

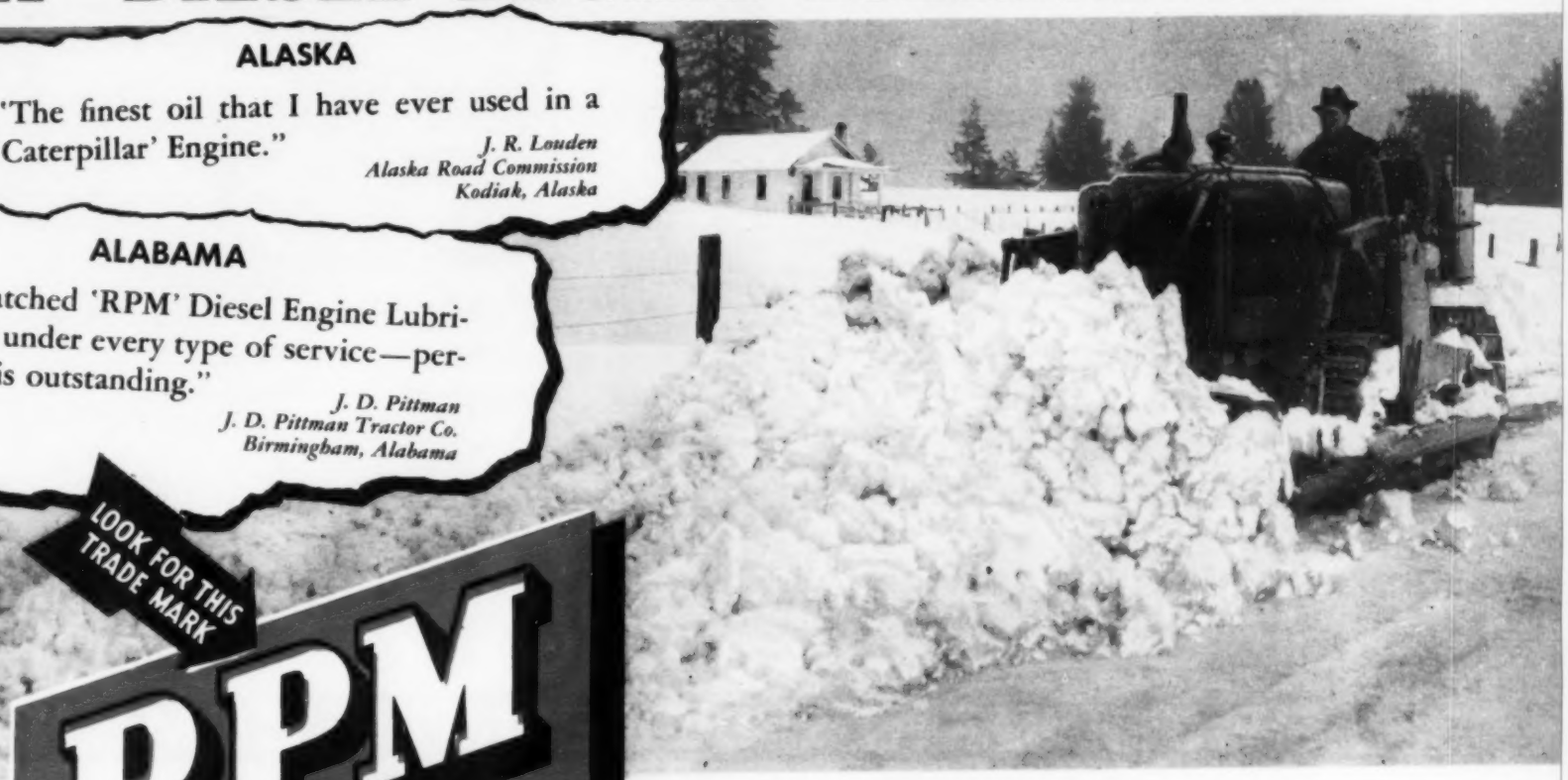
"The finest oil that I have ever used in a 'Caterpillar' Engine."

J. R. Louden
Alaska Road Commission
Kodiak, Alaska

ALABAMA

"Have watched 'RPM' Diesel Engine Lubricating Oil under every type of service—performance is outstanding."

J. D. Pittman
J. D. Pittman Tractor Co.
Birmingham, Alabama



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DIESEL ENGINE LUBRICATING OIL

Caution: There is only one Diesel engine lubricating oil identified by the "RPM" trade-mark.

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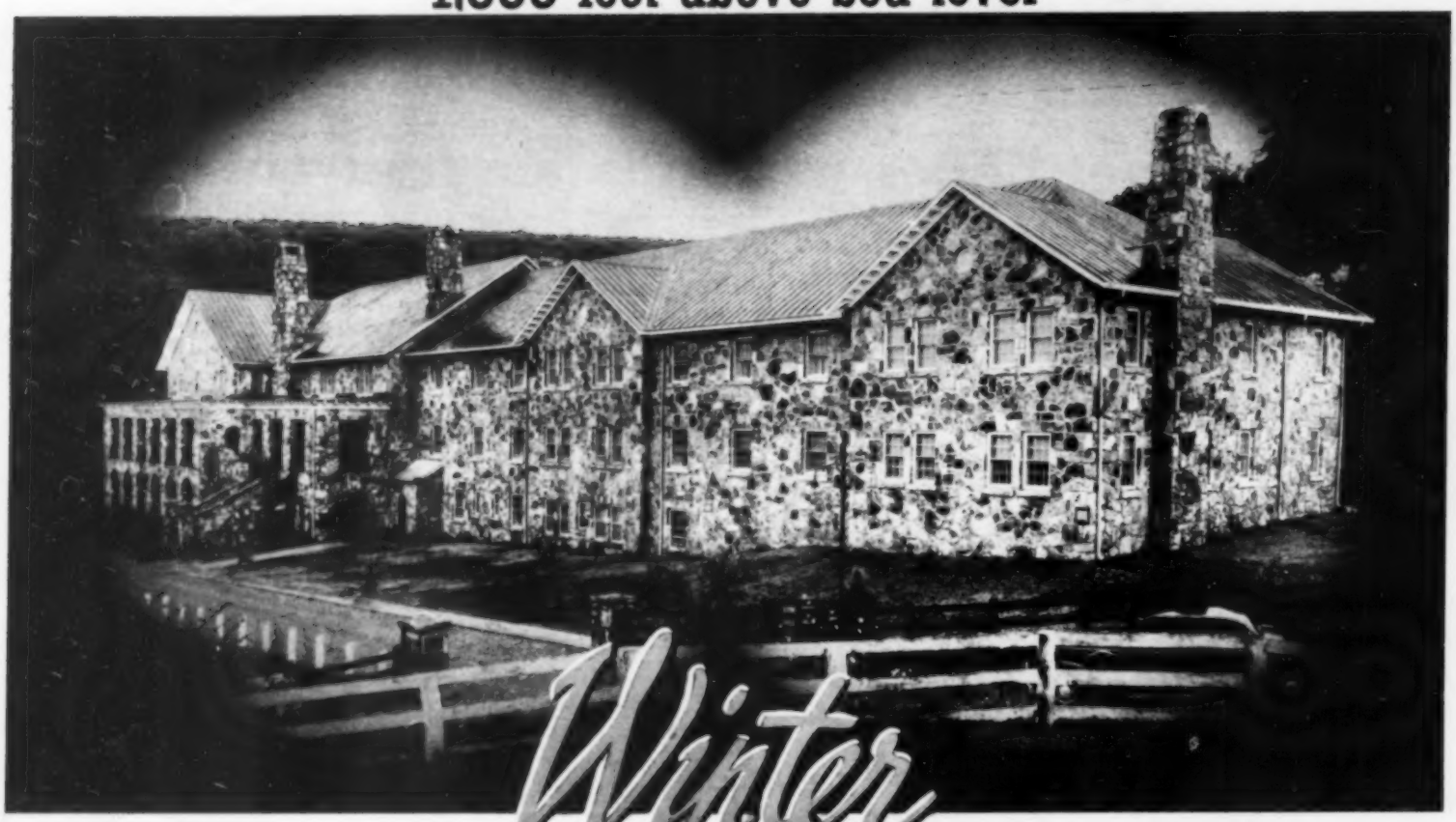
DAY AFTER DAY come letters from everywhere—acclaiming "RPM" Diesel Engine Lubricating Oil! It's proof that patented super-active "RPM" Diesel Engine Lubricating Oil will keep your "Caterpillar" Diesel Engine at its peak efficiency throughout a heavy, strenuous season.

It's proof that the bugbears of carbonization, sludge and excessive overhauls for carbon removal have been licked. Pistons stay clean—the rings free—compression and power at maximum . . . Test it for yourself. Insist on the *patented* lubricant identified by the "RPM" trade-mark. Recommended by Caterpillar Tractor Co.—and by Diesel engine operators in all corners of the globe!

STANDARD OIL COMPANY OF CALIFORNIA

4,000 feet above sea level



was no barrier to continuous construction

with

LEHIGH EARLY STRENGTH CEMENT

Mountain Lake Hotel
Giles County, Virginia
Owner: National Hotels Corporation, Dallas, Texas

Blankets are not unusual in summer at this mountain resort—winters are severe.

Alternate mild and cold spells. Varying day and night temperatures. Winter construction using ordinary methods of heat protection for concrete curing would have been expensive and delayed completion.

Lehigh Early Strength Cement made quick service concrete for rubble masonry walls, floors, and steps. The heat-curing period was less than one-third what it would have been with normal portland cement. Heat-curing costs and waiting time for concrete to harden were reduced accordingly. The superintendent figured an actual saving of 30 days. The hotel was ready for guests on June 1st.

Speed in curing concrete to service strength, so essential in winter, is advantageous any season. Under any conditions, Lehigh Early Strength Cement always cures to service strength in two-thirds to four-fifths less time than normal portland cement. This means—fewer forms, through earlier removal and re-use, reduced construction costs through better co-ordination, reduced overhead through quicker completion.

The Lehigh Service Department will gladly aid in determining the advantage of Lehigh Early Strength Cement for any specific purpose.

LEHIGH PORTLAND CEMENT COMPANY
Allentown, Pa. Chicago, Ill. Spokane, Wash.

DIG BASEMENTS THIS NEW, Profitable W

See the LORAIN EXHIBIT

ARBA

ROAD SHOW

CLEVELAND

JANUARY 17-21

THEW ENTER DRIVE

PERFORMANCE FACTS

Here is the record based on actual installation reports. The L-40 Backdigger will dig a 24' x 28' x 8' basement, with sewer trench, in 9 hours. It will average 2 such basements a day, including 2 moves. Sewer trench 11 ft. deep can be dug at the rate of 1 lineal foot per minute.

How's that for moving dirt? And remember—the ¾-yd. Lorain-40 weighs and costs but little more than most ½-yd. units. Write today for a catalog describing this versatile machine.

with a 3/4-YD. LORAIN-40 BACKDIGGER

1 Machine is always on top—no mats, no "wet bottom" troubles, no ramps to dig and backfill.

2 It cuts vertical walls evenly and straight. It levels and grades the floor; digs and trims the corners squarely and neatly.

3 It reduces the amount of hand trimming and grading to a minimum. One man can more than take care of it.

4 Transfers materials to spoil banks for grading later, or loads into trucks. Can spoil bank material on only 2 or 3 sides to keep ends open for delivery of materials.

5 Digs sewer trenches with straight sides and level bottom as a part of the regular job.

6 Combines the positive digging power and speed of a shovel with the "on top" advantages and greater operating ranges of a clamshell.

7 It handles a 44" wide bucket of full ¾-yd. capacity. Also available with bucket widths in ⅝, ½ and ⅜ yd. capacity.

8 One boom structure serves for either backdigger or shovel use, giving ready convertibility with minimum effort and expense.

UNIVERSAL CRANE DIVISION • THE THEW SHOVEL COMPANY • LORAIN, OHIO

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Your confidence in our product is one of our most valued assets — the backlog of our business which glows brighter each year. We take this opportunity to cordially thank you for this confidence and to re-affirm our eighty-year old policy of concentrating on quality first.
It is because of this policy that "HERCULES" **Red-Strand** Wire Rope gives you more service . . . more operating profits . . . more satisfaction.

A. LESCHEN & SONS ROPE COMPANY

Wire Rope Makers — Established 1857

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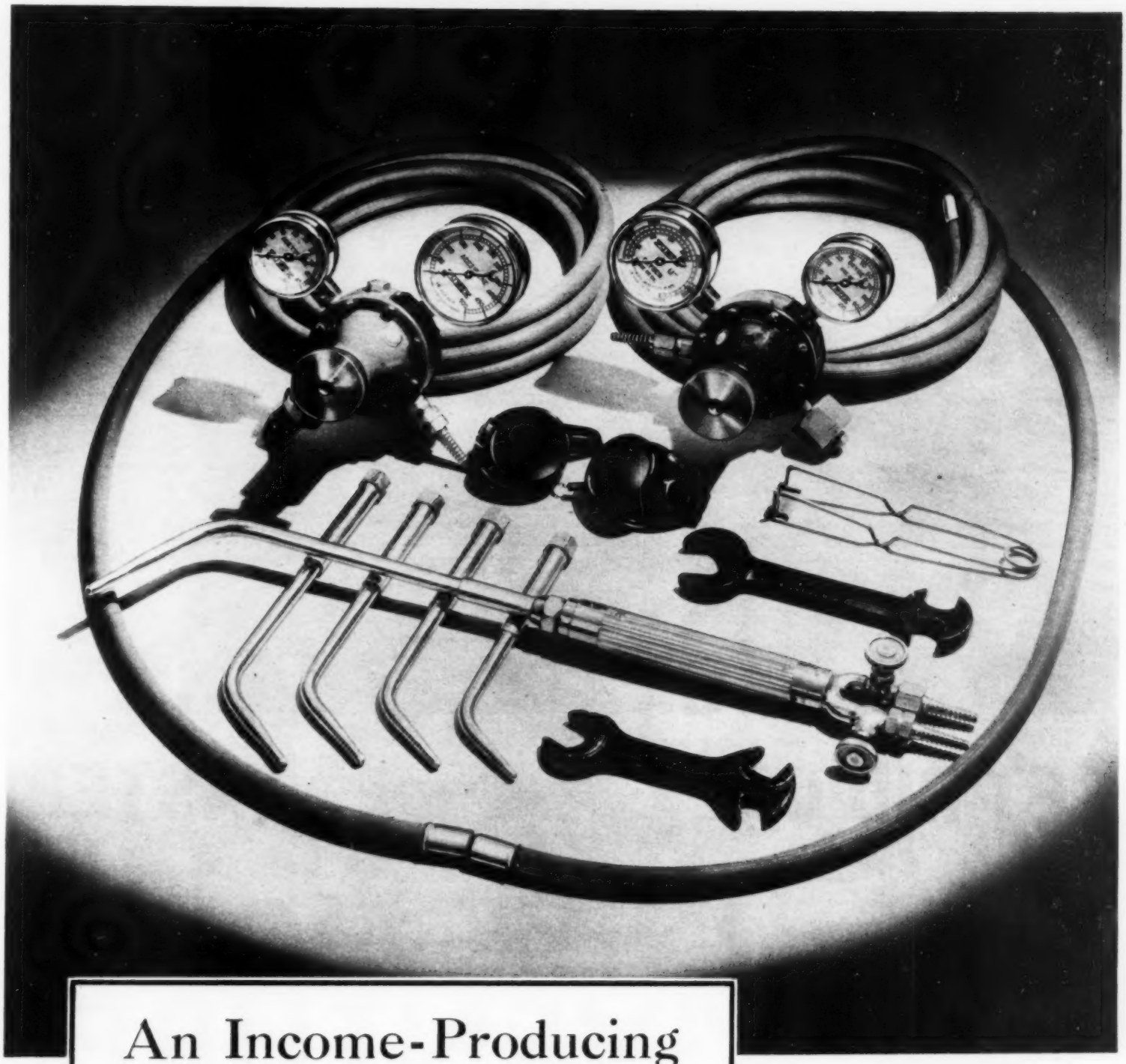
Seattle..2244 First Avenue South



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The Purox* No. 4022 Oxy-Acetylene Welding Outfit. Price $62.25

● Have your jobber demonstrate this moderately priced Purox outfit—a complete, efficient, economical equipment assembly for both light and heavy welding. Notice that it includes the standard all-purpose Purox No. 35 Torch, Purox regulators of the Standard Series and all necessary accessories. With this outfit good welds can be made quickly and profitably.

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Unit of Union Carbide and Carbon Corporation

UCC

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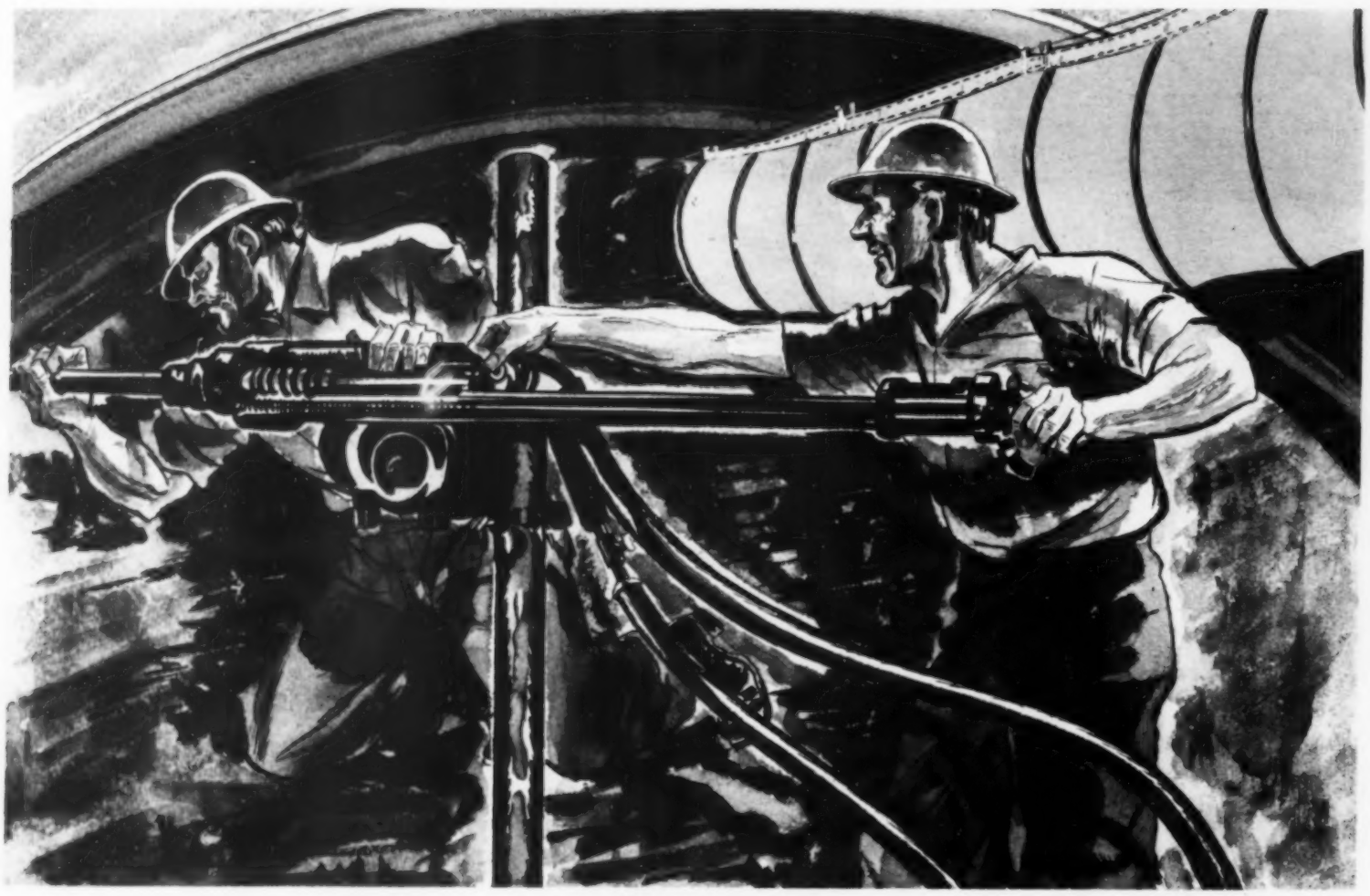
*Trade-Mark

PUROX

WELDING AND CUTTING APPARATUS AND SUPPLIES

PRODUCTS OF A UNIT OF UCC UNION CARBIDE AND CARBON CORPORATION

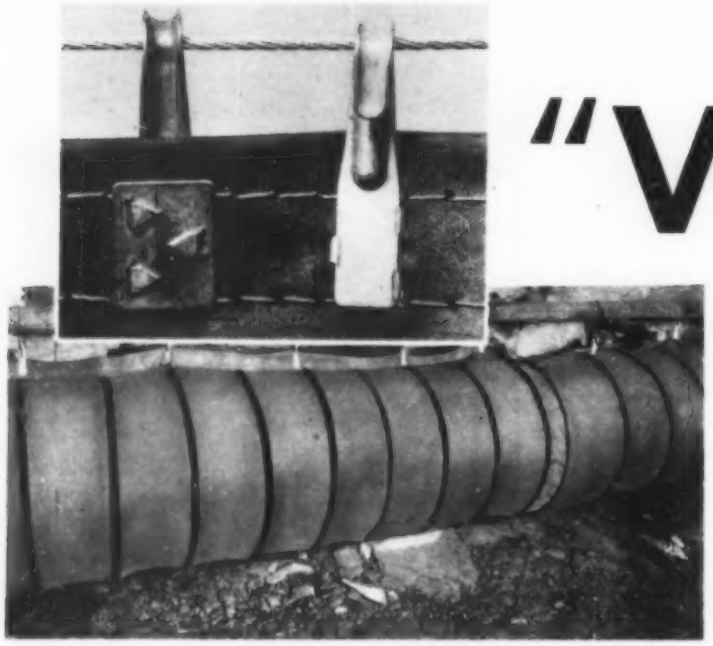
L1114



GET RID OF DUST FASTER

with

"VENTUBE"



(*Above*) This new-type suspension hook is exceptionally secure—easy to handle and saves time.

•

(*Below*) The most recent development in the "Ventube" line—non-collapsible for exhausting dust and stale air.

DU PONT VENTUBE

THE FLEXIBLE VENTILATING DUCT

Dust costs you money! It slows up work! It's dangerous!

Eliminate costly delays by using "Ventube," the flexible ventilating duct—the safest, surest, most economical way to get perfect tunnel ventilation. "Ventube" provides adequate fresh air to the remote faces and forces out drilling and blasting dusts *quickly*.

"Ventube" is extremely tough as well as flexible. It's made of extra-heavy, long-fibered Hessian cloth, *both coated and impregnated* with resistant rubber. Flexible "Ventube" weaves in and out of irregular passages, eliminating costly breakthroughs. It hangs fast! The new detachable coupling saves time. And when blasting, "Ventube" slides back quickly and easily.

Test "Ventube" on your toughest job. Install a few sections and see for yourself under actual working conditions how "Ventube" saves man-hours and cuts costs. Distributors are within easy reach.

E. I. DU PONT DE NEMOURS & CO., INC.

"Fabrikoid" Division *Fairfield, Conn.*

FROM START TO FINISH YOU CAN DO IT BETTER ON THE "STEEL HIGHWAY"

● It's a whale of a load—but these Athey Forged-Trak 2-Way Dump Trailers are *double-husky.* And because they are so easy to maneuver, you can get them right up close to the dipper — a big saving in loading time.

● Smoothly — steadily — surely—the "steel highway" carries your big loads anywhere. For bad weather and ground conditions, nothing can equal the efficiency of steel wheels running on steel rails over a self-laying steel roadbed!

● See how fast and clean these 2-Way units dump, either to right or left! Use them singly or in train, with "Caterpillar" Diesel Tractor to get constant production and lower hauling costs than you've ever known before! See your "Caterpillar" dealer or write us.

dependable off the pavement hauling . . . .

ATHEY TRUSS WHEEL CO
5631 West 65th Street
Chicago, Illinois
Cable Address: "Trusswheel," Chicago

ATHEY
Forged-Trak
2 WAY DUMP TRAILERS

Now: AMERICA

"CATERPILLAR" DIESELS BUILD TRANSATLANTIC AIRPORT AT NEWFOUNDLAND

Shades of Christopher Columbus! You may now fly across the Atlantic in 12 hours, or thereabouts. It's a small world, getting smaller. At the Newfoundland base, the following "Caterpillar" Diesel equipment is preparing the ground where transatlantic planes will take-off: Sixteen Diesel D7 Tractors, three Diesel D6 Tractors, eight Diesel Engines, two Diesel Auto Patrols, and one No. 6 Grader. Later, four "Caterpillar" Diesel generator sets will be installed for lighting the field and buildings, for operating the elaborate radio equipment. Happy Landing!

As the Pilots Say: "Level Off!"—Here is a "Caterpillar" Diesel D7 Tractor with LaPlant-Choate bulldozer spreading material dumped by the wagons.

Crushing Rock for Runways—Modern stone-crusher, powered by a "Caterpillar" Diesel Engine. Stone will make runways for land-planes which will act as feeders to flying-boats.

Visit our quarter-million-dollar exhibit at the Construction and Road Building Show in Cleveland.

to EUROPE

Leveling and Filling—Two "Caterpillar" Diesel-powered shovels load the rocky material onto Athey dump-wagons, pulled by "Caterpillar" Diesel Tractors.

CATERPILLAR TRACTOR CO.
PEORIA, ILL.

WORLD'S LARGEST MANUFACTURER OF DIESEL ENGINES, TRACK-TYPE TRACTORS AND ROAD MACHINERY

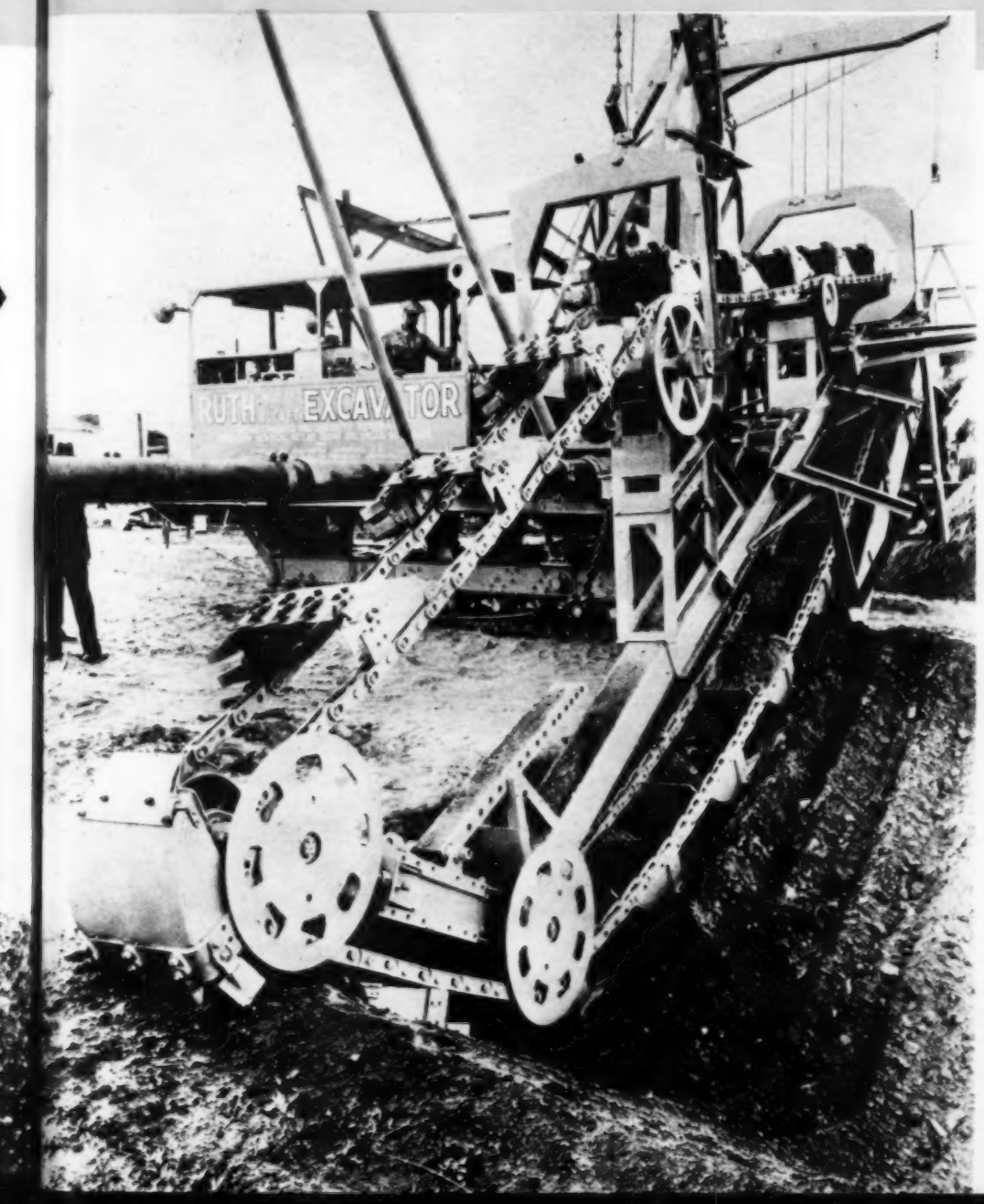
"Caterpillar" DIESELS DO

"AMERICAN" LOCOMOTIVE CRANE equipped with "Caterpillar" Diesel D13000 Engine (125 hp.). Consumed 4455 gallons of Diesel fuel in 2400 hours in 1936. Operation at Flushing, Long Island, N. Y.

"RUTH" H-V EXCAVATOR equipped with "Caterpillar" Diesel D8800 Engine (80 hp.). Positive self-emptying buckets on dredger. And positive power with the "Caterpillar" Diesel! Capacity, 3 cubic yards per minute.

"PLYMOUTH" LOCOMOTIVE built by Fate, Root, Heath Co., and equipped with "Caterpillar" Diesel D17000 Engine (160 hp.). This and other "Caterpillar"-driven locomotives move cars of sand and gravel for a large Western crushing and screening plant.

THE WORLD'S WORK



"VERSATILITY" is "Caterpillar" Diesel Engines' middle name. Handling most every kind of power job—and doing it with an economy that puts other types of power in the shade—is their pride.

For this reason, manufacturers of all kinds of equipment are finding that an increasing number of customers are specifying "Caterpillar" Diesel power for their machines.

Such owners know that, no matter where the job may be, the reliability of "Caterpillar" Engine performance is backed by a complete organization of service-men and facilities, available 24 hours a day.

Specific information will be furnished on request.

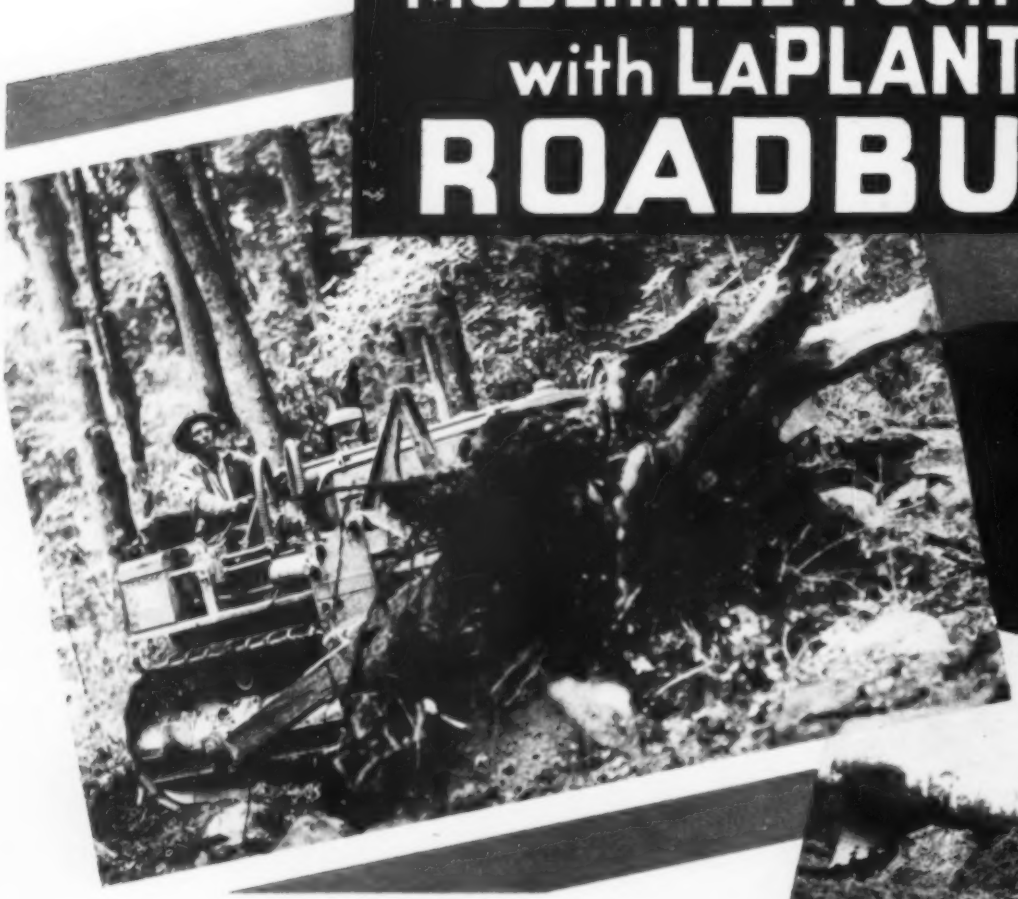
SEVEN ENGINE SIZES—44 TO 160 HP.

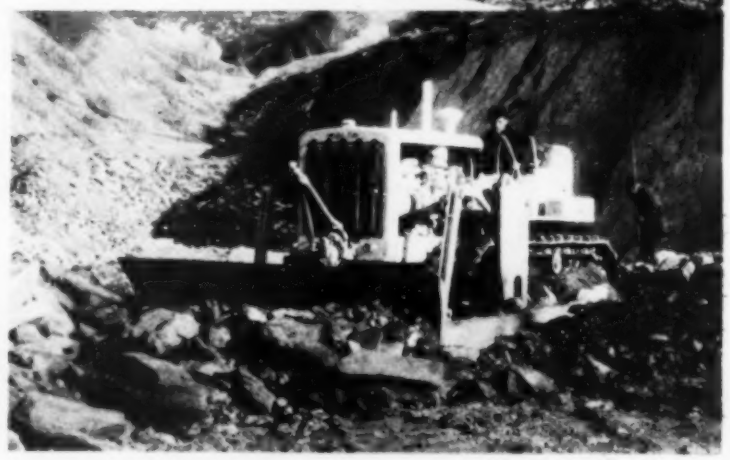
More than 90 leading machinery and equipment manufacturers power their products with "Caterpillar" Diesel Engines.

CATERPILLAR DIESEL ENGINES

CATERPILLAR TRACTOR CO., PEORIA, ILL. . . . WORLD'S LARGEST MANUFACTURER OF DIESEL ENGINES

MODERNIZE YOUR EQUIPMENT with LaPLANT-CHOATE ROADBUILDERS.





1. COMPLETE HYDRAULIC CONTROL
2. ONE-MAN OPERATION
3. ADAPTABLE TO MANY JOBS
4. PROVED COST-REDUCING FEATURES

Positive one-man Hydraulic Control enables modern La Plant-Choate Roadbuilders to do work heretofore considered impossible for such equipment. Because the hydraulic fluid is absolutely incompressible, the blade will positively lock in any position for removing trees, stumps, or rocks which formerly required dynamite or big shovels. Hydraulic control assures unfailing down pressure when you want the blade to dig and permits fine, close work. Hydraulic lifts cushion shocks and help cut service and upkeep costs. These are but a few of the money-saving, labor-saving features of the famous LaPlant-Choate Roadbuilders. They do better work . . . more dependable work at lower cost.

These nationally known units are designed exclusively for use on "Caterpillar" track-type tractors. This is your assurance of competent, readily available service facilities from any of the hundreds of "Caterpillar" dealers throughout the country. Get full details on LaPlant-Choate Roadbuilders from your "Caterpillar" dealer or write to the manufacturer.

TAMPING ROLLERS
SCRAPERS • BULLDOZERS

LA PLANT-CHOATE MANUFACTURING CO. Inc.

RUBBER WHEELED WAGONS
BRUSH CUTTERS • SNOW PLOWS

CEDAR RAPIDS, IOWA.

Cheaper excavation! Lower cost materials moving! Speed — more speed! The equipment *must* permit a profit; finish contracts on schedule! The echo of contractors' demands of LeTourneau is heard the world over.

LeTourneau factories are doing their utmost to fill these needs — twenty-four hours each week-day. Ahead of the Carryall Scraper that rolls out of the factory and onto the job today are 2,344 other LeTourneau Carryall Scrapers. Enough to move 2,860,000 cubic yards* of earth and rock in a 22-hour day. 1,044 more LeTourneau Scrapers than there were one year ago. And there are enough other LeTourneau units — Angledozers, Bulldozers, Buggies and Rooters — to double that figure. They're cutting costs, speeding projects, both large and small, to a profitable conclusion.

See for yourself what LeTourneau equipment will do. It's working day in, day out — in mud, gumbo, sand and rock. Blistering heat and sub-zero cold affect this rugged, all-weather equipment's operating economies but little. Part of the reason lies in the LeTourneau principle of cable control on all equipment. Its trigger-quick action gives split-second positive control regardless of temperature or weather. Stout construction of the finest alloy steel, welded into one piece *keeps* LeTourneau units on the job constantly producing results — and profits.

Watch it work! There's a LeTourneau fleet owner near you. Compare their operating costs. Actual Job Data, certified for accuracy is available. Ask our Field Engineering Department for job studies similar to your undertaking. Or see your "Caterpillar" Dealer for a demonstration.

* *Based on a very conservative* average of 50 pay yards hourly on a 1,000-foot one-way haul.

ACTUAL JOB DATA

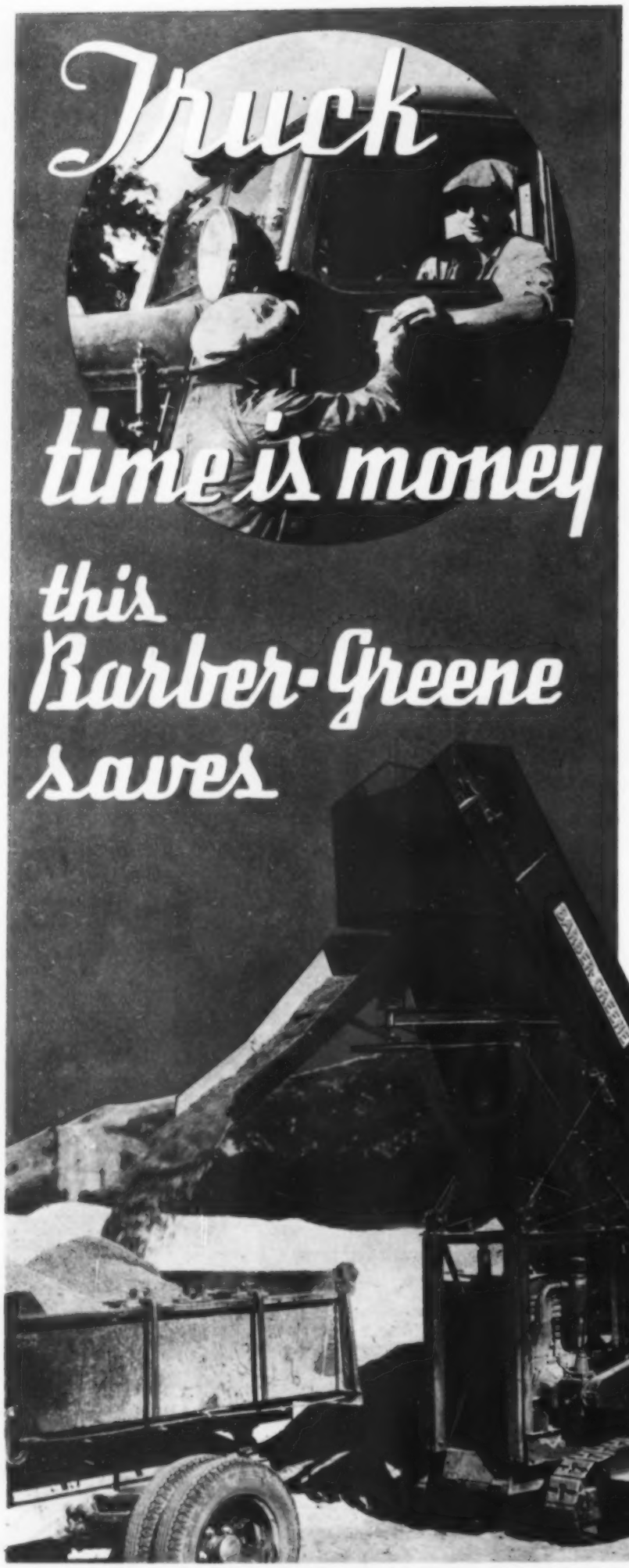
EXCAVATING WET, STICKY CLAY and mud did not stop Contractors Potts & Callahan on an excavation job near Washington, D. C. Their LeTourneau U-12 Carryall Scraper and "Caterpillar" RD8 Tractor combination loaded to heaping measure in 110 feet, requiring but 1.3 minutes, on a maximum 8% favorable grade. Round trip hauls of 2200 feet averaged 8.2 minutes — 14 loads in 1 hour, 55 minutes. At 8 excavation yards per load, a long proved certainty, this means 112 yards per hour. Tough digging and carrying *is* profitable.

LETOURNEAU

R. G. LeTOURNEAU, INC., • Peoria, Illinois • Stockton, California • Cable Address: "Bobletorno"

Manufacturers of: **Angledozers*, Buggies*, Bulldozers, Carryall* Scrapers, Cranes, Drag Scrapers, Rooters*, Power Control Units, Treedozers.**

***Name Registered U. S. Patent Office.**



IF you haven't carefully checked your itemized costs, you'll probably find "Truck Time" one of the biggest leaks in your job system.

Barber-Greene Model 82 Loaders have often made it possible to reduce the number of trucks. On other jobs truck time savings paid for the loader before the job was half done. A loader that's rated at 2 to 3 yards a minute—has been clocked at 4—doesn't take long to load your biggest truck—can't cause appreciable truck waiting.

Consider your present loading system from this important angle—and then consider the many superior features of this Barber-Greene Loader: Synchronized Feeding, Tank Type Chassis Frame, Automatic Overload Release, Super Maneuvering, Slow Crowding, Parallelogram Oscillating Axle, and many others.

A card will bring complete details—there is no obligation.

36-31

BARBER GREENE

BARBER-GREENE COMPANY

530 West Park Ave., Aurora, Ill.

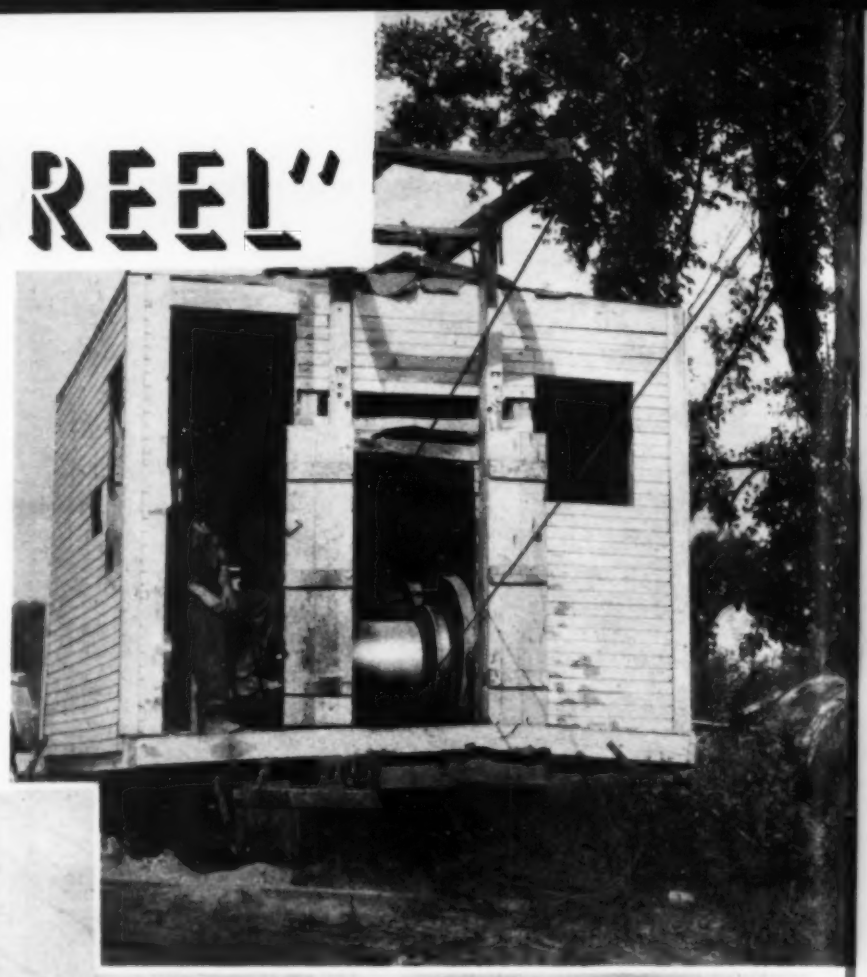
STANDARDIZED MATERIAL HANDLING MACHINES

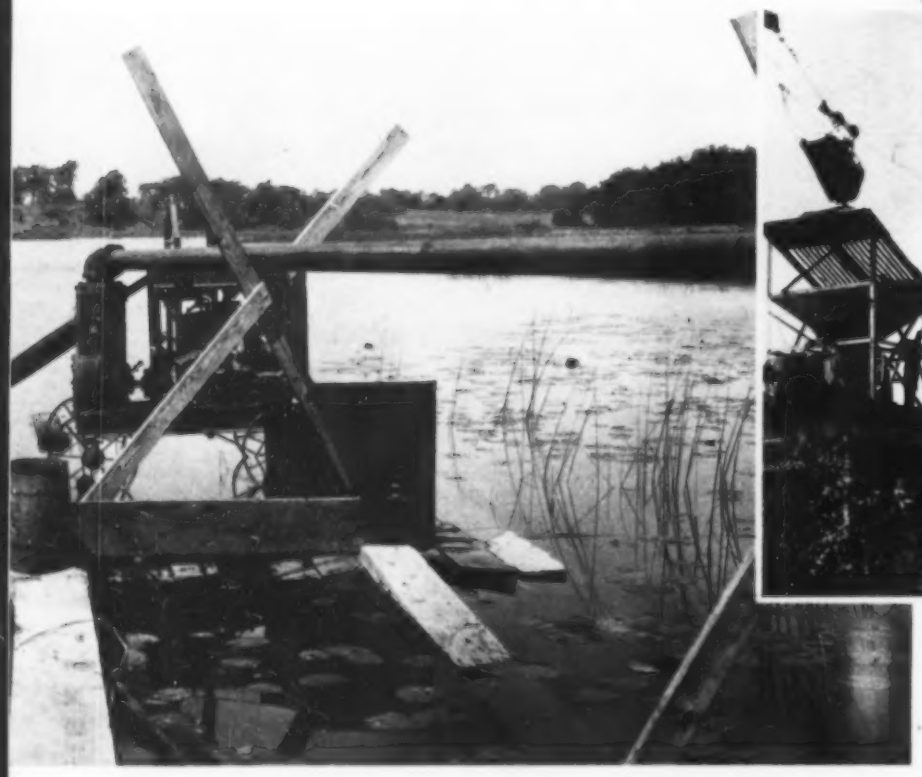
This Month's

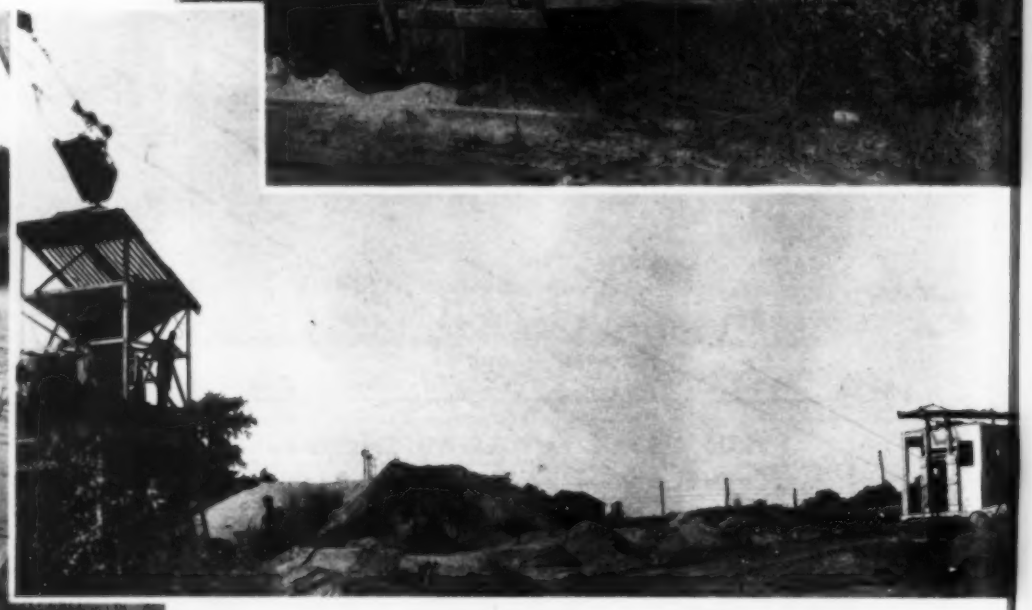
NOVO "NEWS REEL"

VETERAN HOIST (right) — Another veteran that has been taking it for 13 years is this Novo 40 H.P., 2 drum hoist. On construction, dragline, and now on slackline cable way work for C. R. Harrman at Bryan, Ohio. It handles a ½ yd. bucket which loads to ¼ yards — over a 400′ span to the top of the screening plant. The operator, E. L. Brown, who is a veteran in hoist experience, although not in years, says, "That's the best dog gone hoist I ever operated." — Send the coupon for hoist literature.

FLOATING PUMP (below) — This Novo 6" Self-Priming Centrifugal Pump had to all but learn to swim on this job. It is being used by the State Highway Dept. in a swampy section to supply water to a large Novo Jetting Pump one mile away on Route #59 near Pontiac, Mich. The highway fill here is being settled by jetting out the peat and marl under the fill by using 60 or more jetting points.





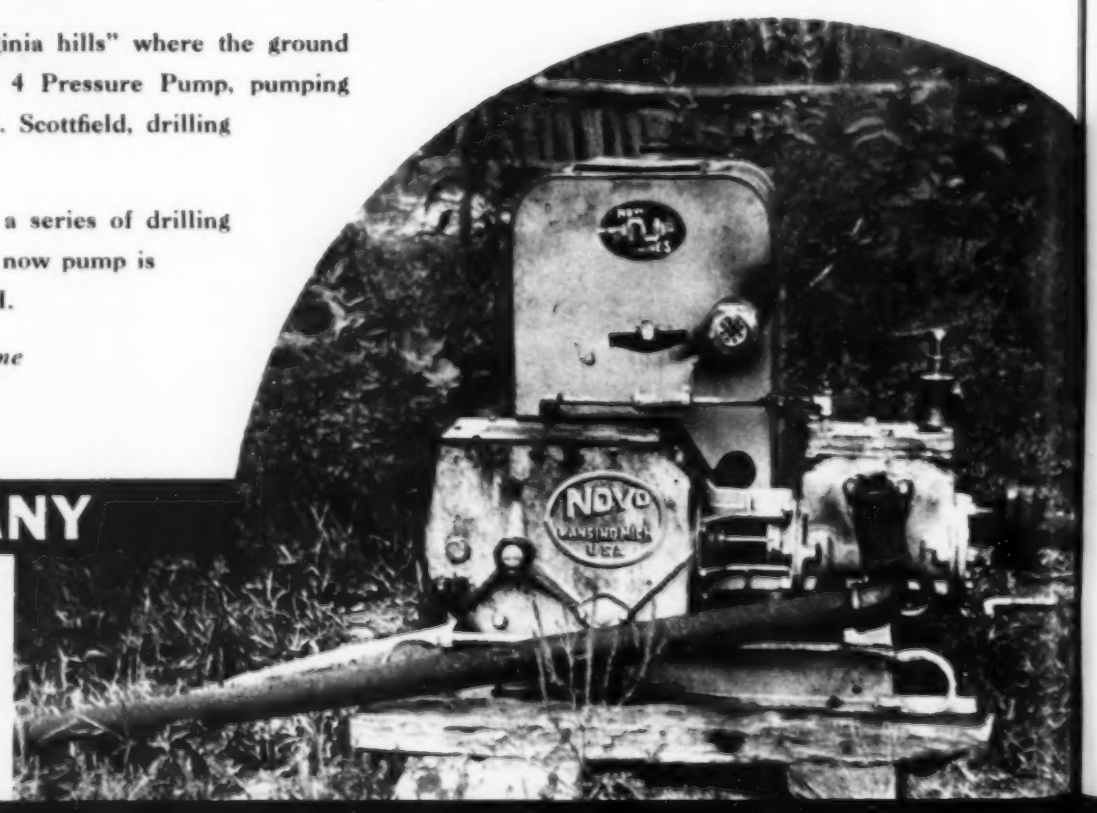


(Above) C. R. Harrman Gravel Plant at Bryan, Ohio, on which the above mentioned Novo Hoist is used.

IN THE HILLS (right) — "Among those West Virginia hills" where the ground is rough and the pumping is tough, is this Novo 3 x 4 Pressure Pump, pumping water up to the gas well drilling operations of W. H. Scottfield, drilling contractor of Glenville, W. Va.

Water is pumped from a creek in the background to a series of drilling operations, each location being farther up the hill until now pump is working against a 350′ head and is furnishing 1500 GPH.

Send for literature on this most complete line of contractors' Pressure Pumps.



IOVO ENGINE COMPANY

214 PORTER STREET • LANSING, MICHIGAN

l literature and prices on:
VO Pumps, Self-Primers ☐ Pressure ☐
VO Hoists, Dragline ☐ Builders ☐
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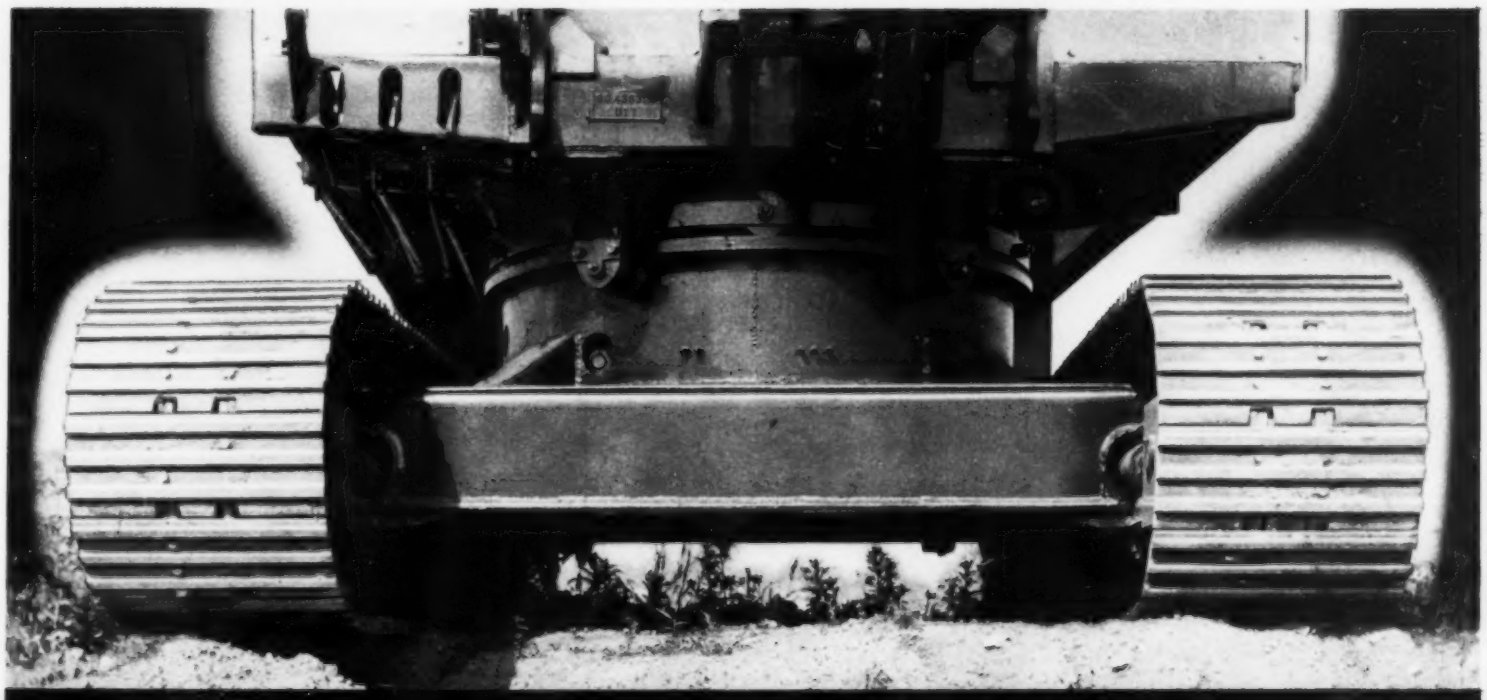
THESE ARE THE INDUSTRY'S *Most Dependable* CRAWLERS

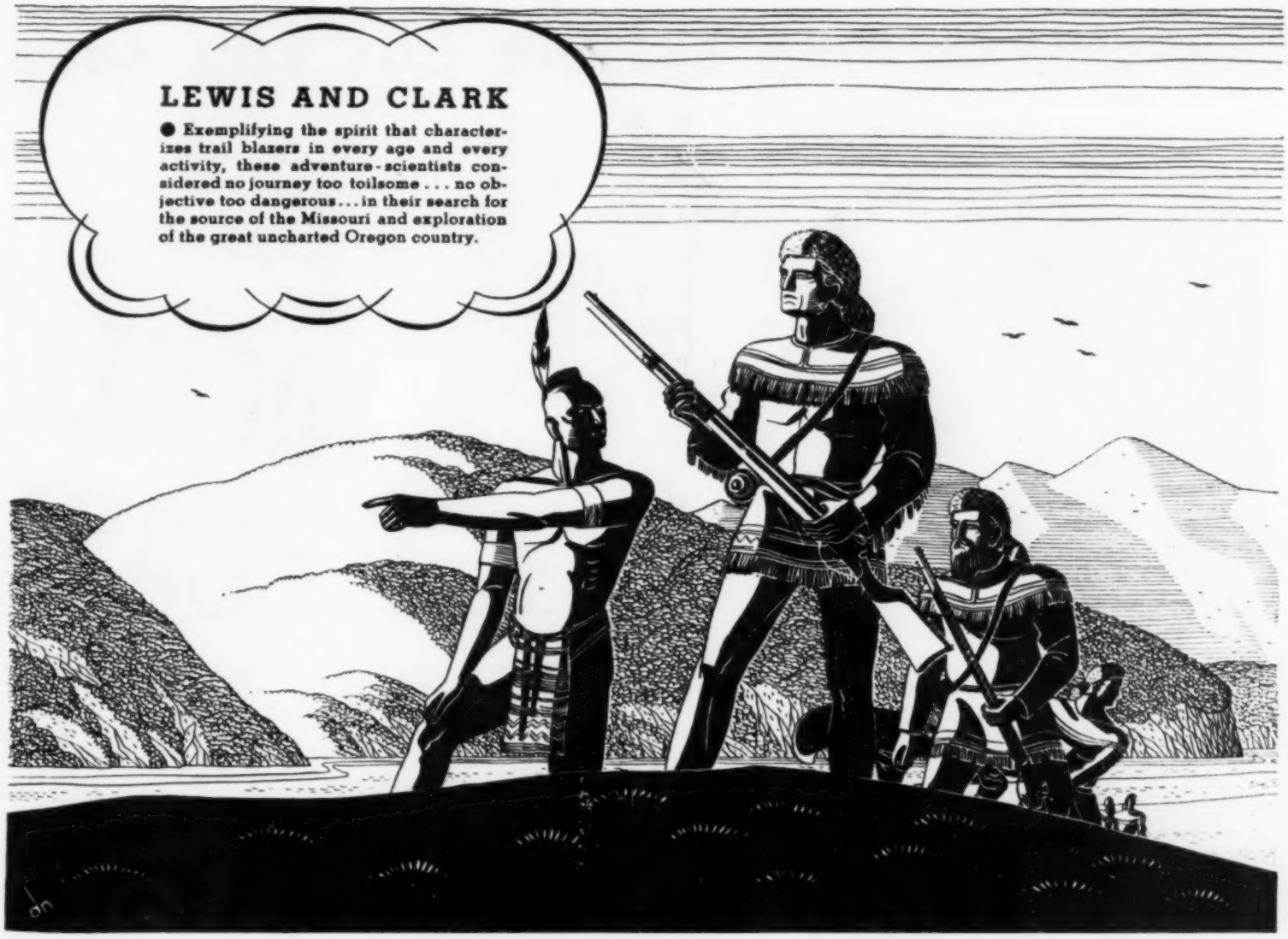


P&H Pacemakers-FASTER ON THE JOB

J. L. HICKOX
When it comes to moving, the only machine that beats my P&H is a tractor.

● It's a fact that these tractor-type crawlers (found on all P&H machines from $\frac{3}{8}$ to $1\frac{1}{2}$-yard) will travel faster and farther with less trouble than any other type used on excavators. Powerful chain drives and crawler belts are always kept at proper tension with compensator springs . . . you get the true rolling movement that means smooth tractor travel and far less chance of breakdown. For information on the size machine you need, address the Harnischfeger Corporation, 4404 W. National Avenue, Milwaukee, Wis.

HARNISCHFEGER
CORPORATION
EXCAVATORS • ELECTRIC CRANES • ARC WELDERS P&H HOISTS • WELDING ELECTRODES • MOTORS



THE TRAIL BLAZER SPIRIT

. . . . Driving Force of Progress in American Road Building.

THE development of road construction to its present efficiency is the result of the energy and vision of resourceful men who have broken through the limiting barriers of old ideas and old methods in every department of the industry. In the removal of mechanical limitations that held early operations to rule-of-thumb accuracy and a snail's pace, Austin-Western has maintained a constant leadership.

With the courage to travel uncharted engineering trails . . . with a keen appreciation of the Industry's need for quicker, better, more economical equipment, and the resourcefulness to meet the challenge . . . Austin-Western (1) made the first Elevating Grader and the first 3-Wheeled Elevating Grader; (2) the first Diesel Powered Motor Grader; (3) made the first Wide Axle Motor Grader with Leaning Wheels; (4) perfected Hydraulic Control for road machines; (5) created the Roll-A-Plane Principle of Road Rolling . . . and pioneered many other major improvements that have become, or are rapidly becoming, standard for the industry.

Furthermore . . . as efficiency-promoting new machines to be announced in 1938 will demonstrate . . . Austin-Western continues to blaze important trails of engineering achievement with equipment that will further accelerate progress in American road building.

Austin-Western

SEND FOR LITERATURE ▶

THE AUSTIN-WESTERN ROAD MACHINERY CO.
1814 Barrows Street, Aurora, Ill.

☐ Send a salesman.

Tell me more about:

☐ Elevating Graders	☐ 12-Yard Scraper
☐ Blade Graders	☐ 5-Yard Scraper
☐ Motor Graders	☐ Rippers & Scarifiers
☐ Road Rollers & Roll-A-Planes	☐ Bituminous Distributors
☐ Motor Sweepers	☐ Gravel Washing Plants
☐ Shovels and Cranes	☐ Crushing & Screening Plants

GL794

Name.....

Address.....

City..... *State*.....

Abrasives may scrape but you save

● Pump casing in service on a dredge in harbor of San Diego, Calif. Its makers, Golden State and Miners Iron Works Co., of San Francisco, added 1.50 to 2% Nickel and 0.50% chromium to increase strength and resistance to wear and abrasion.

...when your Pump Casing is made of

NICKEL CAST IRON

● Abrasives? Ask the owners of this big pump casing what they know about them. Here's what this casing has done up to date:

She works on a dredge in San Diego harbor. She has handled 3,200,000 cubic yards of material... and her owners estimate she is good for at least 1,000,000 more. And look at what's in that material:

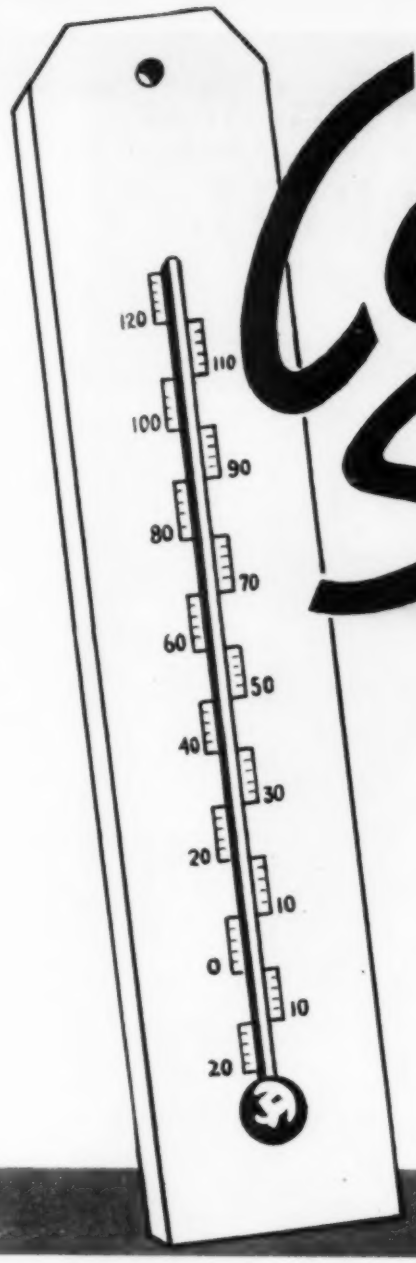
It averages 5% rock, 20% gravel, and 10% silt. Do you wonder that in this casing's lifetime the owners have worn through 4 steel runners . . . so far?

Golden State and Miners Iron Works Co., makers of the casing, have found the sure way to make it stand the scrape of harsh abrasives. They use an alloy cast iron containing 1.50 to 2.00% Nickel, with about 0.50% chromium.

The modern foundry has learned that small amounts of Nickel give the dense uniform grain structure which means resistance to stress, and abrasion, which greatly improve casting properties as well.

The experience of the Inco engineers reaches into many fields. Consultation on your casting problems is invited.

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK, N. Y.



Cold Starting!

Just touch the button and the Cummins Diesel starts instantly. No choking. No coaxing. No warming up. Its extreme flexibility says "Yes" to every throttle change. Owners claim that the Cummins Diesel starts easier than any other internal combustion engine . . . . gas or diesel.

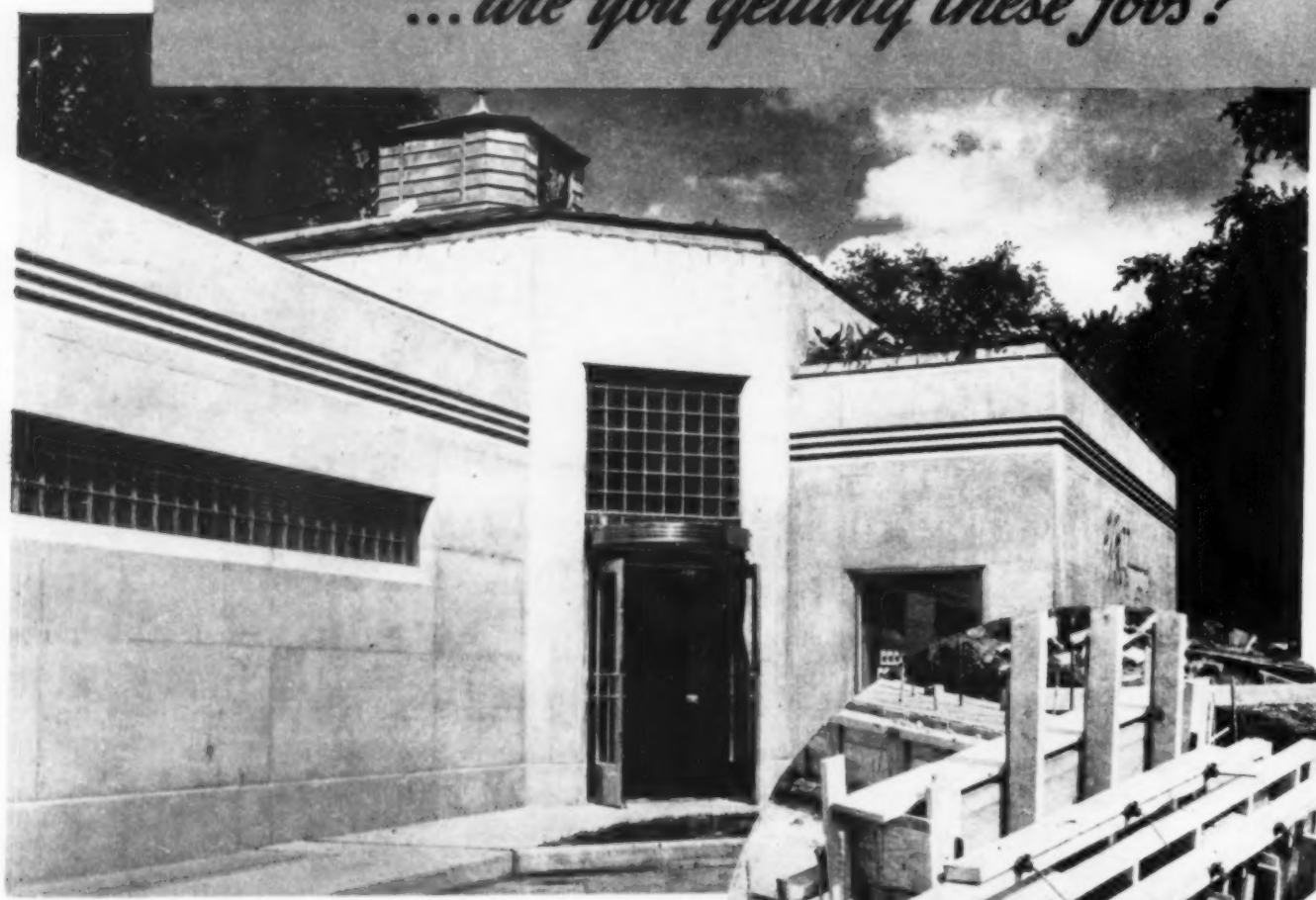
Get the facts. Learn why *cold starting* has *always* been characteristic of the Cummins Diesel . . . why its fuel distribution and injection system, different from all other diesels, is positive assurance that the Cummins Diesel will start instantly even in sub-zero weather. Ask for Bulletin FS-100. Cummins Engine Company, 1702 Wilson Street, Columbus, Indiana.

CUMMINS *Dependable* DIESEL

PIONEER IN MODERN DIESEL DEVELOPMENT

Smart building owners made 1937 a record year for ARCHITECTURAL CONCRETE

... are you getting these jobs?



Well tied and braced forms insured true alignment.

Accurately constructed forms with plywood sheathing assured smoothness of the finished wall.

ARCHITECTURAL CONCRETE jobs are a common sight these days. Go from city to city and you will see walls and ornamental detail being cast in the forms along with the frame and floors . . . all in concrete!

Talk to owners and you'll find them more than satisfied — with fine-looking buildings that are fireproof, durable, and requiring little maintenance for many years.

It will pay you to get in on such contracts. Learn the construction technique by which contractors can deliver weather-resistant, top quality concrete at low cost. Details are outlined in booklet, *"Forms for Architectural Concrete,"* and the handy *"Concrete Guide, with Tables of Quantities of Materials."* Write for your free copies.

PORTLAND CEMENT ASSOCIATION
DEPT. 12-16, 33 W. GRAND AVE., CHICAGO, ILL.

A National Organization to Improve and Extend the Uses of Concrete

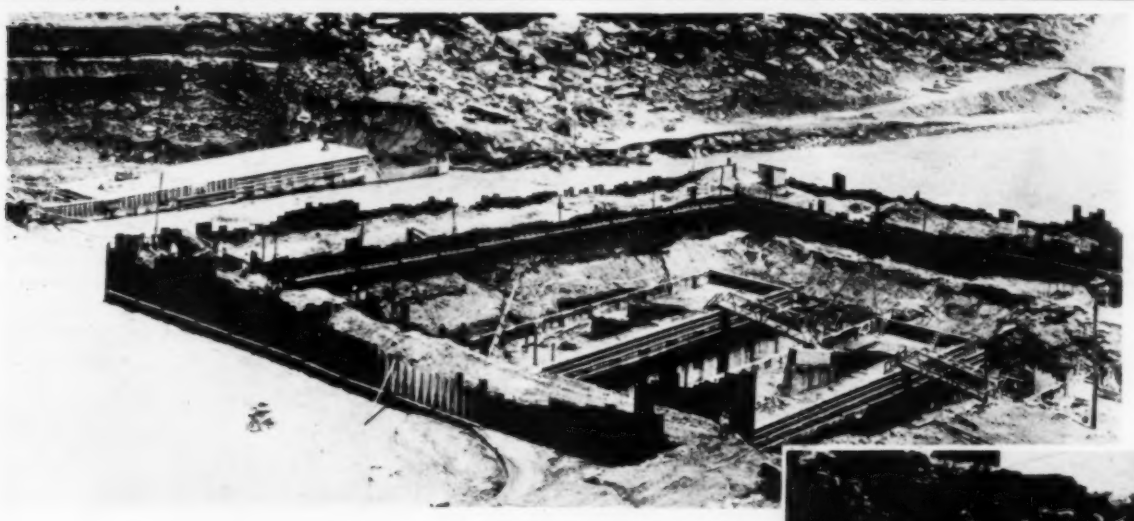
(Above) Wolferman's Store, Kansas City, Missouri, was designed by Edward W. Tanner; H. A. Noble, structural engineer; Long Construction Co., contractor. Concrete furnished by Ready-Mixed Concrete Co., Foundations, floors, walls and roof are of dense, weather-resistant, accurately formed concrete.

Construction Methods and Equipment

Established 1919 McGraw-Hill Publishing Company, Inc.

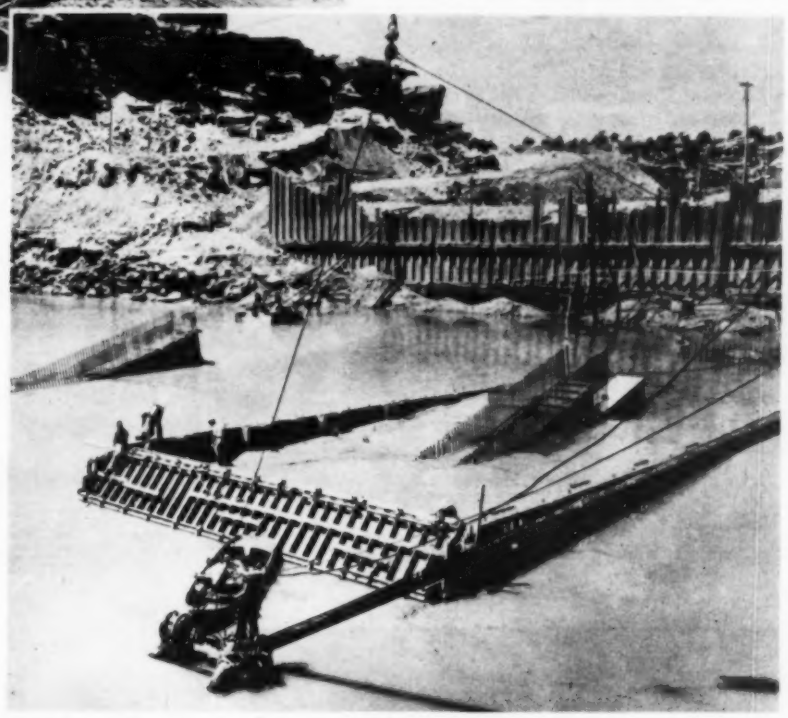
ROBERT K. TOMLIN, Editor

Volume 19 **December, 1937** Number 12



RISING RIVER *(left)*, May 28, 1937, threatens steel sheetpile cofferdam of parallel wall type at Conchas dam.

PUMPS *(below)* dewater cofferdam overtopped by rising river June 2. Photo taken June 7.



Steel Sheetpile

Cofferdam Withstands Floods

COMPLETELY SUBMERGED by one of the worst spring floods in the history of the district a sheet steel cofferdam on the Conchas River, New Mexico, withstood the tremendous beating of the swollen river with practically no damage. The cofferdam, made with Bethlehem Section AP-3 sheetpiling, in a parallel wall construction using two lines of tierod, was designed to take care of an unusual flood which, according to hydrographs, would be roughly 25,000 to 30,000 sec.-ft. About 29,000 sec.-ft. was the highest flood observed in the last 15 years.

FLOODED COFFERDAM as it looked at 6:40 p.m., June 2, before pumps started unwatering area inclosed by sheetpile cofferdam.

During the latter part of May, however, intense rains, or cloud bursts, occurred in this area. As the watershed has a very rapid run-off these rains brought about a flood calculated to be approximately 90,000 sec.-ft., or more than three times the figure for which the cofferdam was designed. The cofferdam was overtopped and considerable erosion took place at the corners, but as a whole it remained intact.

Bent Brothers, Inc., and Griffith Co., of Los Angeles, were the contractors working under the supervision of U. S. Engineer Department, with Captain Hans Kramer in charge as district engineer.

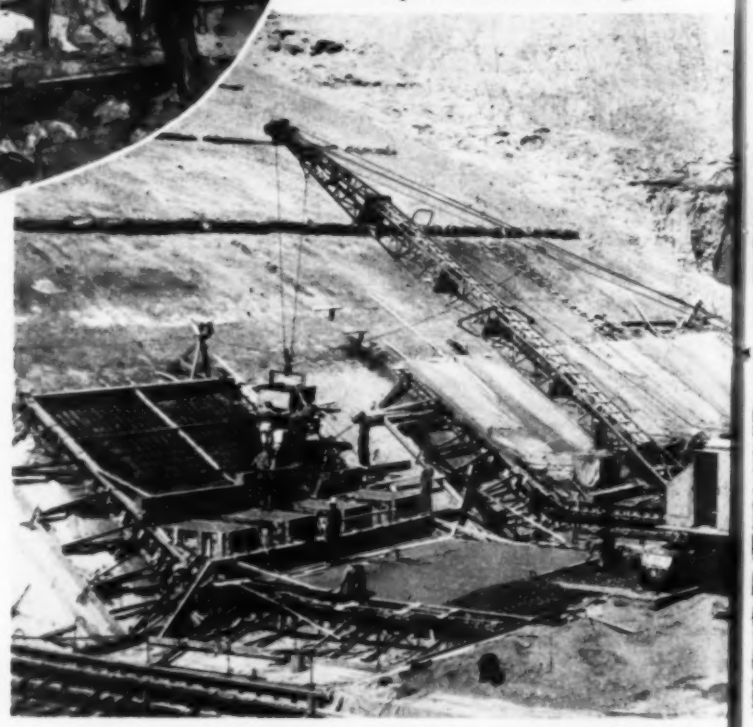
— *Page 37*

LINCOLN TUNNEL

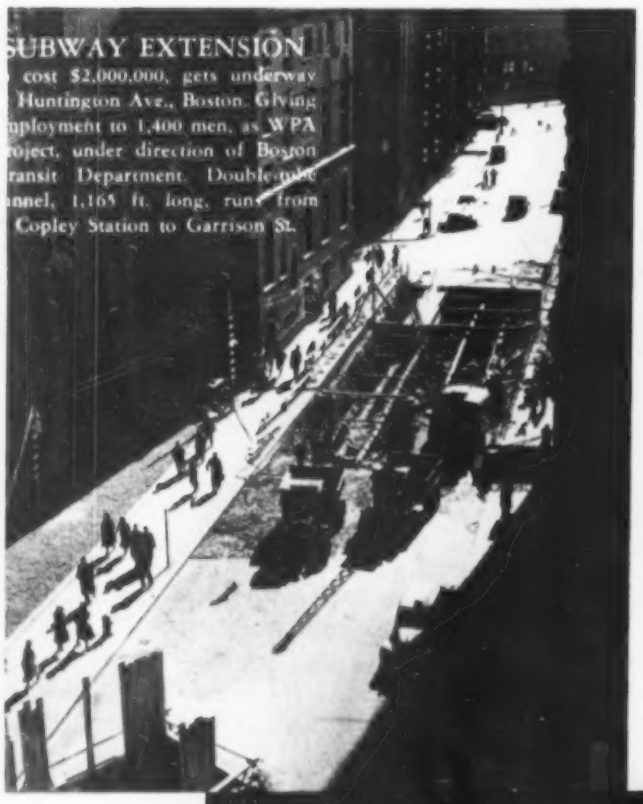
(above) to carry traffic under Hudson River between New York and New Jersey is ready for dedication of first (south) of twin tubes Dec. 21. Built by Mason & Hanger Co., Inc., New York contractor, for Port of New York Authority, 31-ft.-diameter (outside) bore, on which work started in March, 1934, has length of 8,215 ft. between portals, with brick-paved roadway 21 ft. 6 in. wide between curbs. Tunneling through river silt *(right)* was done by compressed-air shield method. Segmental cast-iron lining rings were bolted-up speedily by special hydraulically operated machine. Concrete floor and ceiling slabs in tube form ducts for fresh and vitiated air which is handled by elaborate ventilating system. Walls and ceiling are finished with glass tile.

MASS HOUSING PROJECT

takes form at Chicago, Ill., to provide 1,027 homes for former slum tenant dwellers in low-wage groups. Three-story buildings of Jane Addams project, containing 3,571 rooms, were financed with aid of $7,041,759 PWA allotment. Building group occupies 21 acres. Contractors were B-W Construction Co., for foundations; and S. N. Nielson Co., for superstructures of buildings.

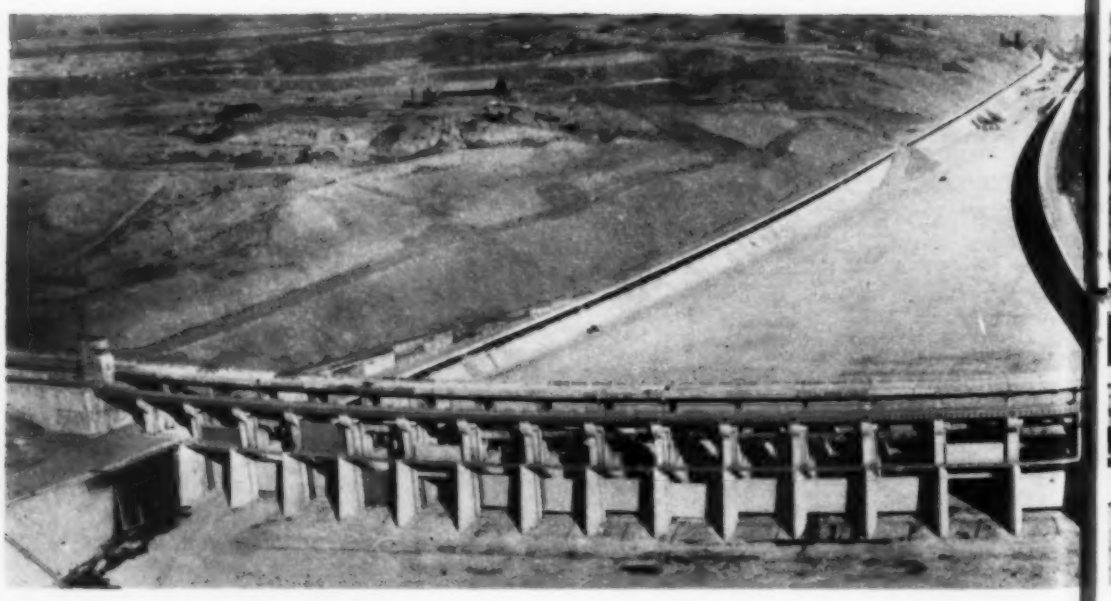


This Month's
"NEWS REEL"



SUBWAY EXTENSION

cost $2,000,000, gets underway Huntington Ave., Boston. Giving employment to 1,400 men, as WPA project, under direction of Boston Transit Department. Double-tube tunnel, 1,165 ft. long, runs from Copley Station to Garrison St.

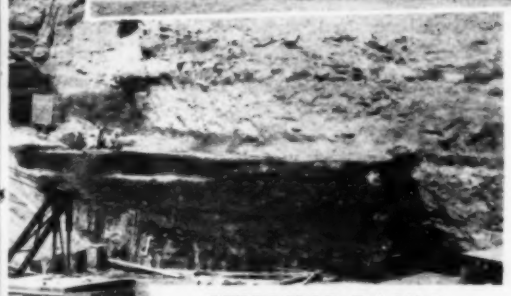


GUNTERSVILLE DAM

TVA project on Tennessee River in Alabama, reaches stage of construction where first section of cofferdam adjoining navigation locks is completed. At left is plant for handling aggregates and mixing concrete.

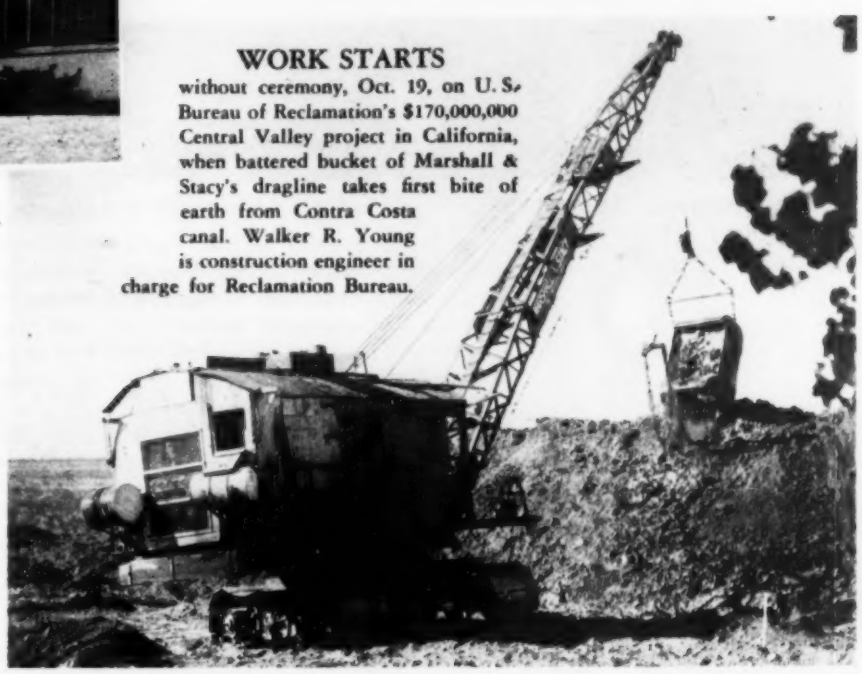
RESEARCH BUILDING

just completed for American Rolling Mill Company, at Middletown, Ohio, at cost of $360,000, is modern streamlined building involving use of porcelain enamel, stainless steel and glass blocks. Structure built by The Austin Company of Cleveland, has all-welded steel frame of rolled shapes.



STILLING BASIN

(left) at spillway of Fresno dam, under construction by U.S. Bureau of Reclamation on Milk River project near Havre, Mont., receives concrete from bucket delivered by crawler crane. Dam, begun last year by Wachter-O'Neill and McGarry Bros., of Bismarck, N.D., is showing rapid progress under direction of H. V. Hubbell, construction engineer for Reclamation Bureau. Contract price, $980,804.

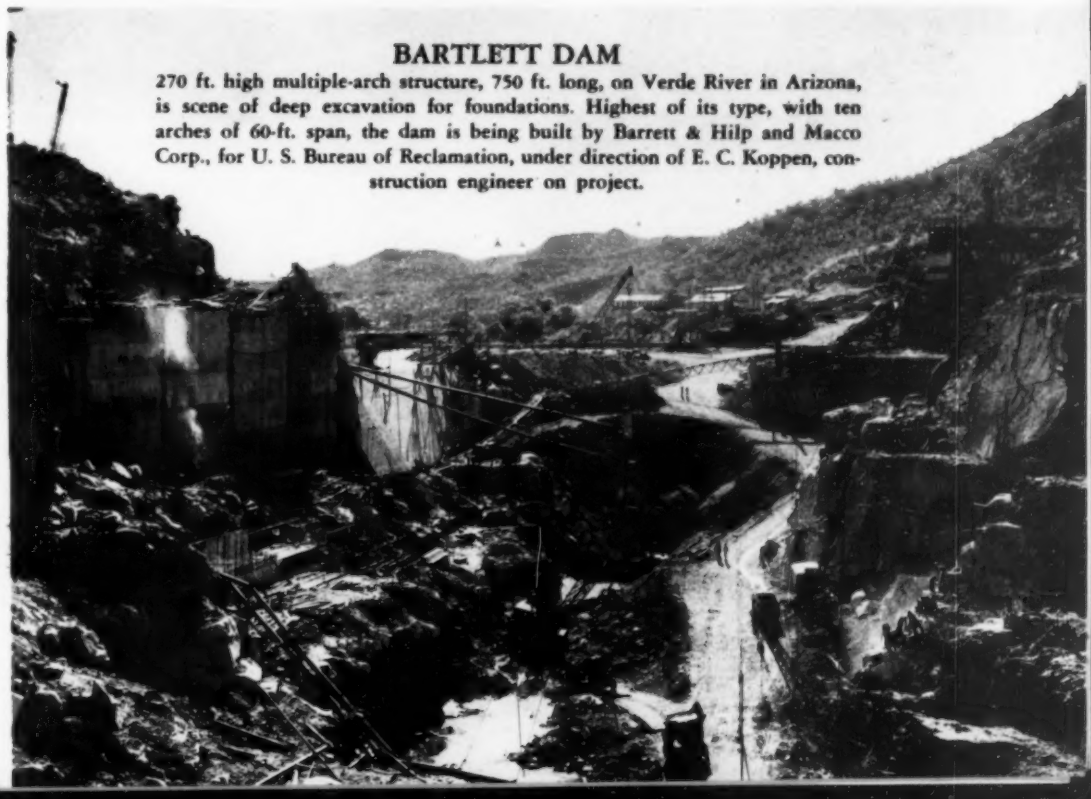


WORK STARTS

without ceremony, Oct. 19, on U. S. Bureau of Reclamation's $170,000,000 Central Valley project in California, when battered bucket of Marshall & Stacy's dragline takes first bite of earth from Contra Costa canal. Walker R. Young is construction engineer in charge for Reclamation Bureau.

GATE STRUCTURE

(left) at flood spillway of Fort Peck dam in Montana, equipped with 16 vertical-lift steel doors, balanced by counterweights, is completed for U. S. Engineer Department by Addison Miller and Fielding & Shepley, contractors. Gates are 25 ft. high. Capacity of spillway is 112,000,000 gal. per minute.

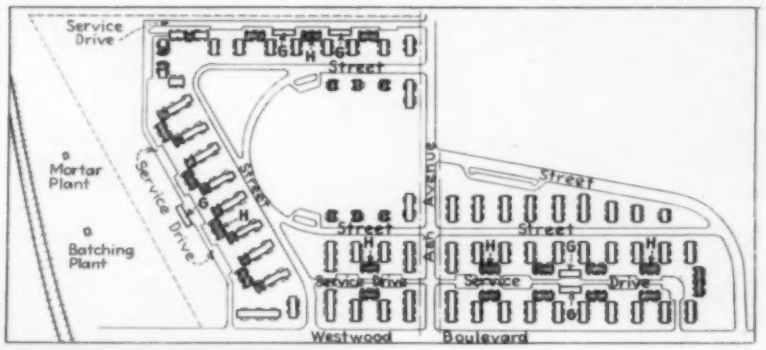


BARTLETT DAM

270 ft. high multiple-arch structure, 750 ft. long, on Verde River in Arizona, is scene of deep excavation for foundations. Highest of its type, with ten arches of 60-ft. span, the dam is being built by Barrett & Hilp and Macco Corp., for U. S. Bureau of Reclamation, under direction of E. C. Koppen, construction engineer on project.

Unified Construction Organization

Replaces Multitude of Subcontractors on Large Housing Project



CONSTRUCTION LAYOUT of Will Rogers Courts, Oklahoma City, Okla., indicates location of concrete batching plant and mortar mixing plant in relation to 85 buildings of project. Cross-hatched buildings are two stories in height; all others are one-story. Units indicated by G are garages; those marked H contain central heating plants supplying steam to all nearby houses. Note eighteen groups (of three buildings each) arranged around individual central courts.

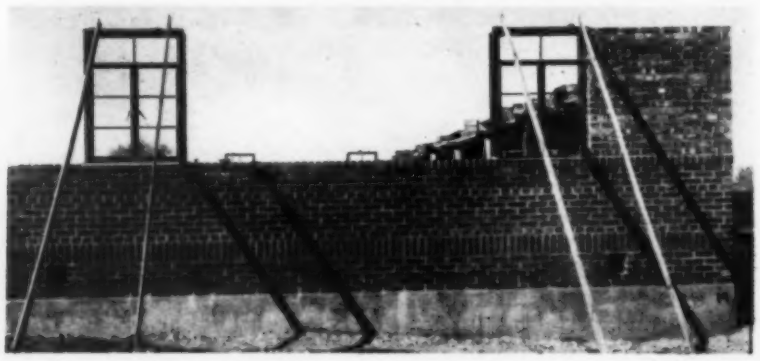
MECHANICAL BACKFILLER covers pipe laid in trench excavated by ladder-type ditching machine.

COMPELLED BY circumstances to forego the normal procedure of awarding mechanical installations to subcontractors, Leo Sanders, Oklahoma City, Okla., general contractor for Will Rogers Courts, PWA housing project, developed a unified construction organization of 500 to 600 men which performed practically all operations involved in erecting the 85 one-story and two-story buildings of this project on a 37-acre plot. Staffed by a group of competent superintendents and foremen, acting under the direction of H. A. Frankenstein, general superintendent, the large organization overcame the shortages of mechanics in various trades by transferring qualified workers from one craft to another as required to maintain satisfactory progress. In this way the contractor carried through without serious interruption a construction schedule calling for progressive erection of the 85 units, holding employment at a uniform level and permitting repeated use of construction equipment and concrete forms.

Foundations — A preliminary contract for the construction of concrete foundations was awarded to Leo Sanders, the low bidder, near the end of 1935 and was completed in June, 1936, at a cost of about $150,000. In general, the foundation consisted of concrete spread footings and walls. Only 23 of the buildings in the project have base-

SLAB CONCRETE is handled from mixer to forms in bottom-dump bucket by crawler crane.

MOBILE HORIZONTAL CONVEYOR traveling on steel rails distributes concrete from paving mixer to foundation forms.



STEEL WINDOW FRAMES are set and anchored in position in advance of masonry wall construction.

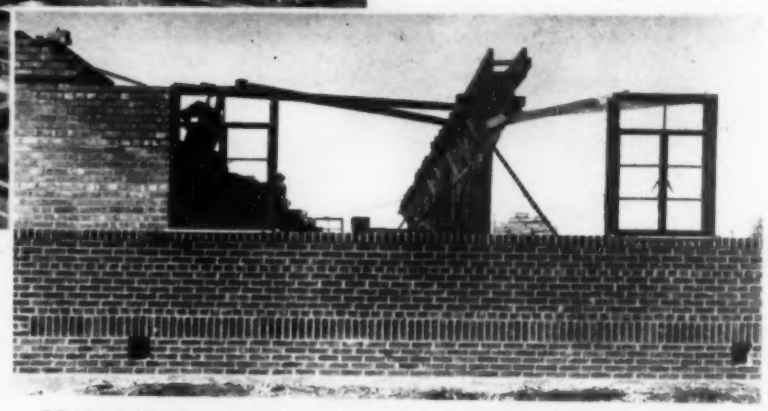
TIMBER JOIST UNITS supported by timber shores will carry composition board forms for floor flap.

ments. Among these basements are distributed six community laundries and five boiler rooms for central heating plants. Steam for heating is conducted through underground mains from the central plants to the various buildings.

Excavation for the foundations amounted to 7,000 cu.yd., while the footings and walls required 6,000 cu.yd. of concrete. Total employment on the foundation contract amounted to 81,545 man-hr.

To furnish concrete for the foundations, the contractor used a 1-cu.yd. paving mixer supplied with dry batches from a plant set up near a railroad siding at the northern end of the tract. The buildings in the project are uniformly 27 ft. wide. To assist the placing of concrete from the paving mixer, the contractor employed a belt conveyor mounted on a rolling bridge which spanned the 27-ft. distance between the side forms of the foundation. A short inclined belt conveyor, suspended from the paver boom, delivered concrete from the mixer to the rolling bridge. A controllable trip on the horizontal conveyor discharged concrete from the belt at any point desired. Operated in combination with the mobile paving mixer, the conveyor equipment enabled the construction crew to place concrete in foundation wall forms at a uniform rate around the entire periphery of a building.

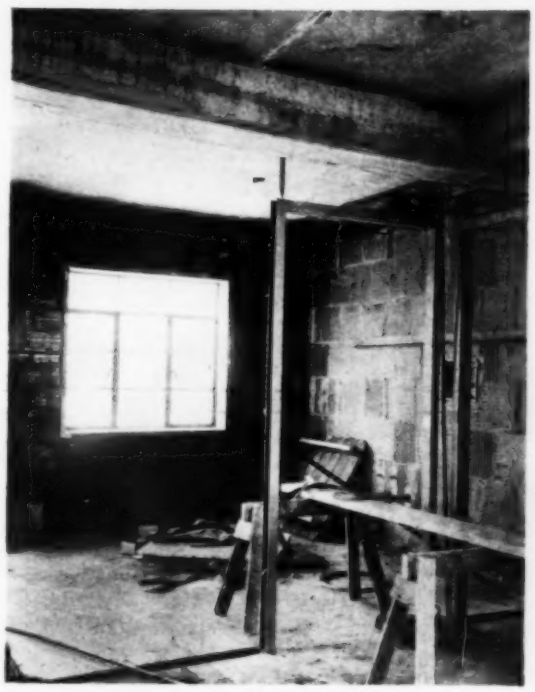
Double-flanged wheels under the rolling conveyor bridge traveled on



BEAM FORMS are erected on line of timber shores which also serve to tie steel window frames in position, prior to erection of walls.

PARTITION *(right)* of metal studs and metal lath separates steel stairway from living room. Metal studs and lath also are applied to some other 2-in. solid plaster interior partitions designed to save space. Walls separating living units are of clay tile.

SPECIAL SHOPS to handle woodworking and pipe threading and cutting expedite work for carpenters and heating and plumbing gangs. In background are typical one- and two-story buildings.



INTERIOR of apartment *(left)* during construction shows steel door bucks erected and exterior wall waterproofed with two coats of asphalt-base sealing compound sprayed on inside surface. Note smooth surface of unfinished ceiling and beams.

STATIONED IN CENTRAL COURT surrounded on three sides by buildings, paving mixer and crane supply concrete to floors and roofs of three houses in group.

INSULATION *(right)* of 1½-in. fiber board is laid on roof prior to application of five-ply built-up felt and gravel roofing.

PIPE SHOP *(below)* equipped with three cutting and threading machines produces duplicate pipe sizes for 354 living units in project.

PLANK SCAFFOLD supported from two ladders provides readily movable working platform for painters.

steel rails supported by the wall forms and by intermediate timber beams. When moving from one building to another, the paving mixer carried the short inclined conveyor while the 27-ft. conveyor was transported on a trailer hooked to a truck.

Superstructure Contract—A superstructure contract for the 85 buildings was awarded to Leo Sanders on a low bid of $1,559,965. This price included the cost of landscaping, kitchen ranges and refrigerators, awarded previously by PWA and added in every general bid at the specified amounts. By the time the superstructure contract is completed, it is expected to have provided a total of more than 625,000 man-hr. of employment.

Living units for 354 families are provided in the 85 houses. These units contain a total of 1,237 rooms. Of the buildings, 50 are one-story structures, and 35 are two-story or partly two-story. Exterior walls of the houses are of load-bearing, masonry construction, 12½ in. thick, with a facing of brick backed up by 8-in. clay tile. Every sixth brick course is tied into the backup tile. Reinforced-concrete floor and roof slabs and beams (having uniform spans of either 10 or 14 ft.) bear on the masonry walls and on interior concrete columns. Roofs are insulated with 1½-in. fiber board under five-ply built-up felt and gravel roofing. An idea of the quantities involved may be obtained from the table shown on the opposite page.

Organization—With the exception of a few operations awarded to subcontractors, the construction force of the general contractor performed all work on the project. Labor and material subcontracts were awarded for the following items: roofing (including insulation and metalwork), glazing, calking, insulation of heating and plumbing lines, cut stone coping, and installation of glazed tile. All other departments of the work were carried on by the main organization.

Directing the work of the large force was a staff of eight superintendents reporting to Mr. Frankenstein. The superintendents were responsible for the following classes of work: two in charge of carpenters and one each in charge of electrical work, masonry, heating, plumbing, plastering and painting. Under the superintendents were sixteen foremen supervising skilled crews and two foremen handling common-labor gangs. About 45 min. before the start of work each morning, the superintendents and foremen met with the general superintendent to coordinate the day's operations and receive their working orders.

Mechanical work of certain trades was expedited by installation of shops on the project. Duplication of pipe sizes in the 354 living units, for example, made it possible and economical to equip and organize a pipe shop on a mass production basis. The shop was equipped with three pipe-cutting and threading machines, one machine for 4- to 1-in. pipe, a second high-speed unit for 2- to 1-in. sizes, and a third portable machine

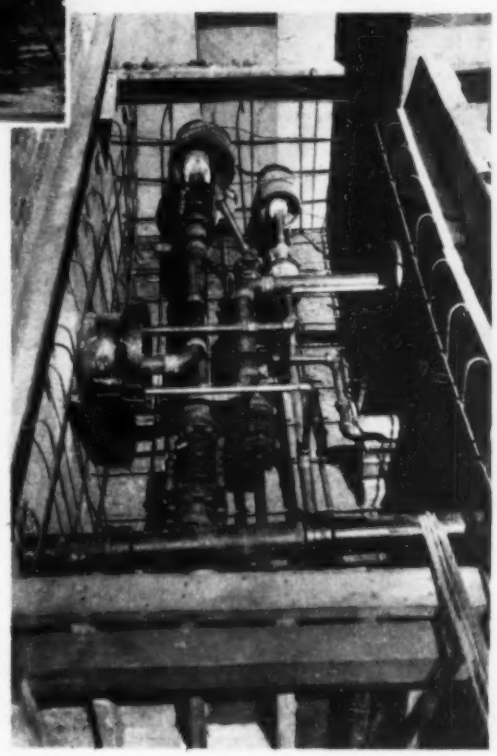
STOUT STAIRWAY at each two-story building eliminates need of ladders and reduces accidents during construction period.

MORTAR for bricklayers is raised by crane to upper floor.

BRICKLAYERS build chimney for gas-fired steam-heating plant located in basement of this building. Cantilevered concrete canopies provide pleasing protection for apartment entrances.

TWO-BATCH TRUCKS *(left)* deliver aggregates to paving mixer from batching plant in background.

EXPANSION CHAMBER *(below)* provides access to expansion devices on underground lines of steam and hot water systems.



for 1½- to ½-in. pipe. This shop also used three electric-welding machines, two of them being portable gasoline-driven units employed in welding the joints of all wrought-iron steam lines. A woodworking shop equipped with power tools aided the carpenters by dimensioning lumber for forms, shores, temporary stairways and other similar units. Frequently the units were prefabricated at the shop ready for erection.

Construction Methods — Because of the low height of the buildings, the contractor relied on cranes exclusively to raise materials to the second floors and roofs. A mortar-mixing plant was erected adjacent to the railroad siding, not far from the concrete batching plant. Light dump trucks hauled mortar from this plant to mortar boxes, at the various buildings, and the boxes were raised to upper levels by the cranes.

Concrete for floor and roof slabs was mixed by the 1-cu.yd. paver and was handled into the forms in 1-cu.yd. roller-gate buckets by the cranes. Slab forms consisted of pressed composition board laid on prefabricated units made up of 2x4-in. timber joists on 7½-in. centers. The contractor averaged four uses of the pressed composition board. Beam forms likewise were lined with composition board on all exposed concrete surfaces. A smooth surface was desired for both beams and ceilings, as these areas were decorated by painting directly on the concrete. Forms were shored under the beams and at one or two intermediate locations under the 10- and 14-ft. spans, respectively.

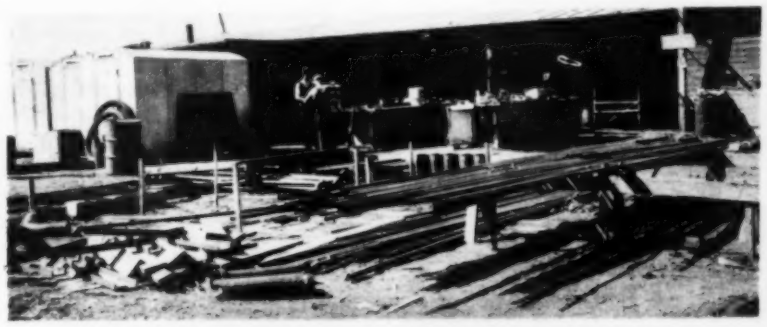
As indicated by the accompanying plan, many of the buildings in the project are arranged in groups of three around small central courts. At these locations, a crawler crane in the central court was able to handle materials for the three buildings with a minimum of travel. A similar central set-up of the plaster mixer served all three buildings when the walls were being plastered.

Partial List of Quantities

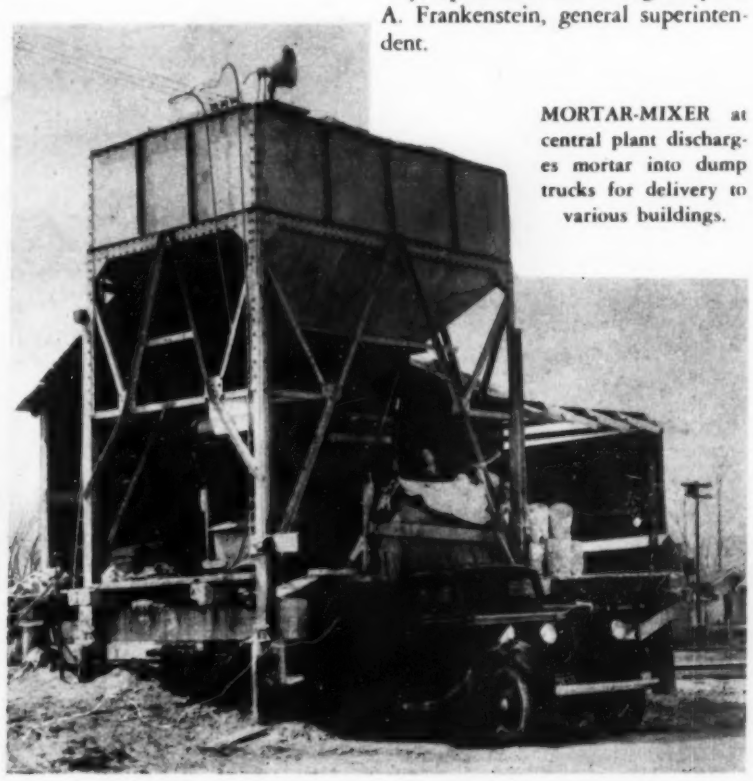
WILL ROGERS COURTS, OKLAHOMA CITY, OKLA.

Item	*Approximate Quantity*
Excavation for buildings	7,000 cu. yd.
Excavation for trenches, etc.	8,000 cu. yd.
Grading	32,000 cu. yd.
Finish grading	150,000 sq. yd.
Foundation concrete	6,000 cu. yd.
Superstructure concrete	10,000 cu. yd.
Cement finish	400,000 sq. ft.
Face brick	1,700,000 units
Interlocking backup tile, 8 in. thick	150,000 sq. ft.
Steel windows	2,750 units
Roofing and insulation	1,800 squares
Exterior door bucks	700 units
Interior door bucks	1,600 units
Metal base	57,400 lin. ft.
Wainscot cap (bathrooms)	4,800 lin. ft.
Metal lath and stud partitions	13,000 sq. yd.
Plaster (walls only)	68,000 sq. yd.
Screed and corner beads	57,000 lin. ft.
Linoleum and asphalt tile flooring	174,000 sq. ft.
Cast-iron soil, waste and vent pipes	22,000 lin. ft.
Copper tubing for water	39,000 lin. ft.
Steel gas pipe	11,000 lin. ft.
Steam lines, branches and returns (in buildings only)	50,000 lin. ft.
Underground lines (steam, steam return, gas, water and hot water)	75,000 lin. ft.
Electrical pipe conduit	60,000 lin. ft.
Electrical wiring conduit	160,000 lin. ft.

Administration — Construction of Will Rogers Courts, Oklahoma City, Okla., is directed for the housing division of PWA by J. W. Johnson, project manager, and Virgil D. Alden, project engineer. For Leo Sanders, general contractor, Oklahoma City, operations are managed by H. A. Frankenstein, general superintendent.



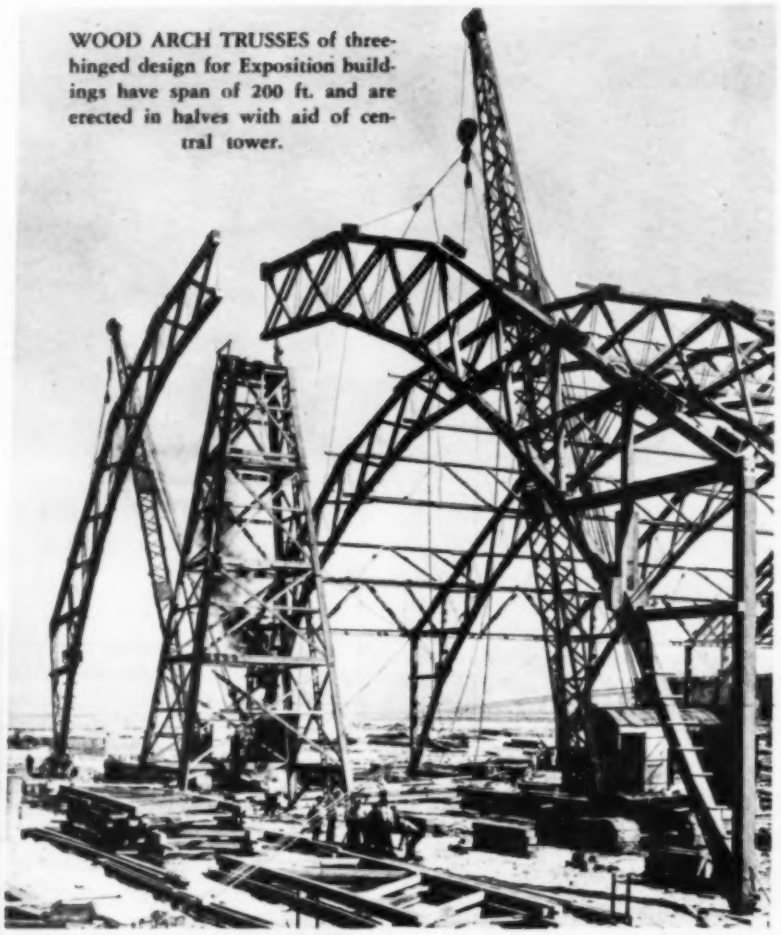
PIPE STOCK in various stages of cutting and threading is stored in front of pipe shop. At left are portable sheet-metal tool sheds of type used in great number on this job.



MORTAR-MIXER at central plant discharges mortar into dump trucks for delivery to various buildings.

Special Tackle Raises *Wood Arch Trusses*

By CHARLES F. BERRY
Golden Gate International Exposition, San Francisco, Calif.



WOOD ARCH TRUSSES of three-hinged design for Exposition buildings have span of 200 ft. and are erected in halves with aid of central tower.

SIX-POINT PICK-UP by crawler crane swings wood truss from ground into vertical position with stresses equalized.

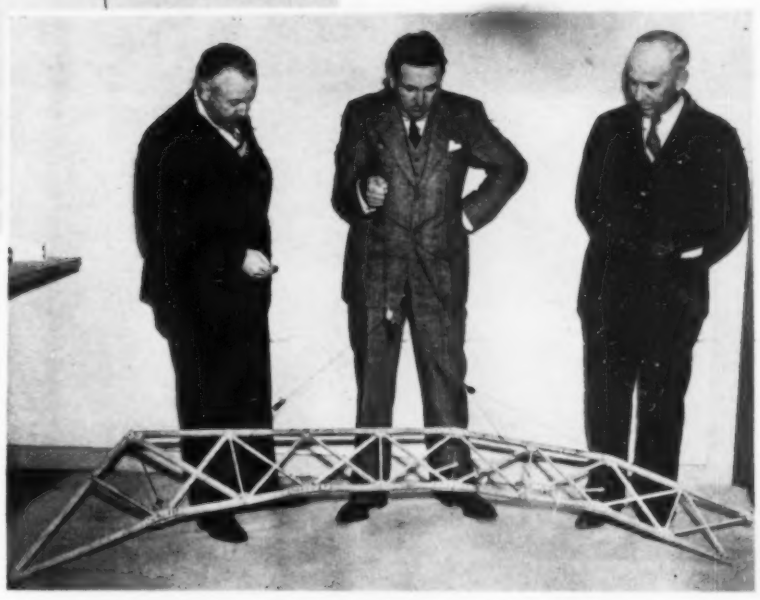
IN ERECTING the 200-ft. three-hinged arches for the exhibit structures of the 1939 Golden Gate International Exposition on San Francisco Bay, an ingenious system of interconnecting cables and pulleys was used with complete success. Because of the unusual size of these arches particular care was necessary to distribute the load uniformly, so as not to overstress the structural members during erection. Each half member of the 200-ft. frame arch weighed 19,800 lb.

To obtain absolute precision in the erection of the arches, cable ties were tried out on an 8-ft. model of the half-arch, scaled to size and weight. After weights and stresses were computed, a six-point pick-up, using six pulleys to equalize the load, was worked out. Construction was carried on by the Guy F. Atkinson Co., of San Francisco.

Because the arches were fabricated and assembled in a horizontal position on the ground, a successful erection procedure had to be devised which would not put excessive stresses into the arches. After some experimentation with the model, an arrangement of pulleys and attachment of wires to the truss was found which brought about a quick rolling of the arch from a horizontal into a vertical position. From this pick-up an analysis was made of the stresses, which indicated that during erection none of the joints or the members

PIN IS ENGAGED *(left)* in ends of arch truss with aid of tall wood construction tower.

STRESS EQUALIZATION *(below)* during erection was predetermined by tests of six-point pick-up on 8-ft. model by John J. Gould *(center)* chief structural engineer for Exposition, D. E. Root *(left)* and E. L. Kier *(right)* with Guy F. Atkinson Co., contractor.



would be overstressed. On account of the free-running cables the loads in the wires could be readily determined with assurance that during erection the stress distribution would generally conform with assumptions of the analysis.

During the erection of the 21 arches for each of the two northerly exhibit buildings on Treasure Island, measuring 200x886 ft., it was observed that erection movements of the model coincided very closely with those developed on the job. Because of the fact that the cable holds had been carefully diagrammed this rather complicated pick-up required no more time than the ordinary pick-up. Truss members were hoisted into place within 5 min. after connections were made. Approximately a half-hour was required to complete the arch cycle and engage the pin. In framing these last two of six exhibit buildings being erected for the exposition by the Atkinson firm, a maximum of four bays was completed in a day. Two cranes with 85-ft. booms were used in erecting the members and a central tower was employed for guiding the arches while the pin was engaged.

All construction work for the $50,000,000 World's Fair of the Pacific is being done under the direction of W. P. Day, vice-president and director of works for the Exposition. H. C. Vensano is chief of construction and John J. Gould is chief of the division of structural engineering, which prepared designs of the structures and the analysis of erection stresses.

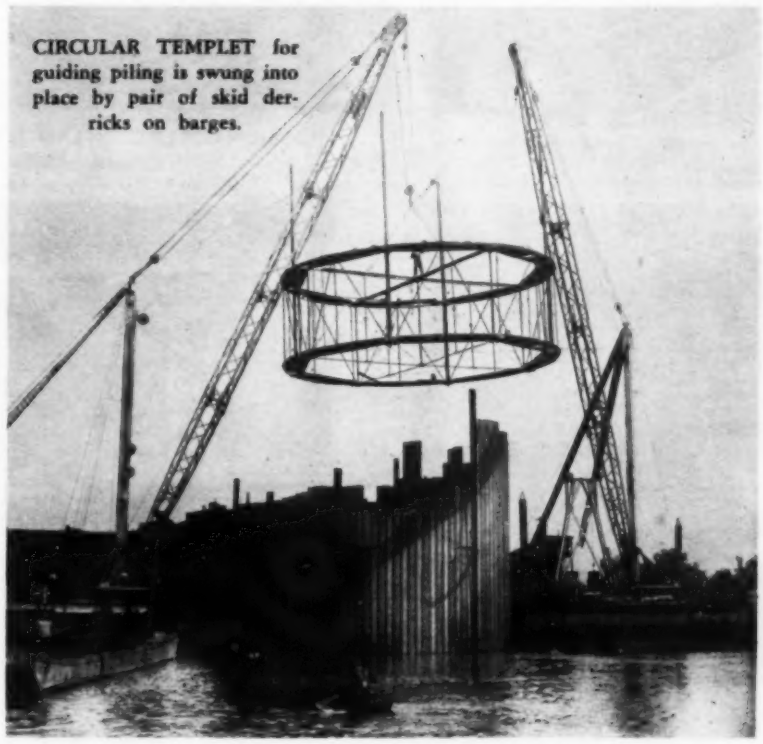
The Guy F. Atkinson Co. are the general contractors for the six main exhibit structures, involving approximately 800,000 sq.ft. of floor area; J. C. Moore is general superintendent for the Atkinson firm and Whitey Standish is boss rigger.

Templet Guides Setting of Sheet Piles

By LEE G. WARREN
Project Engineer, Chickamauga Dam, Tennessee Valley Authority

THE ACCOMPANYING ILLUSTRATION shows the handling of a steel pipe templet for forming circles of sheet steel piling in No. 1 cofferdam for Chickamauga dam, T.V.A. project on the Tennessee River, 7 mi. upstream from Chattanooga. The scheme for this templet was suggested by J. E. Walters, construction superintendent at Pickwick Landing dam, and the detail designs were carried out by H. T. Lofft, associate office engineer there.

Height of templet is 15 ft.; outside diameter 47 ft. 6 in. It is lowered to the surface of the river by two skid derricks and placed in final position. Then 6-in. pipe steel spuds are lowered to river bottom by releasing pins through holes in the pipe, the pipe spuds being driven into the river bottom. The templet is leveled and brought to correct elevation by adjustable pins in the spuds. On the end of the cofferdam cell small arcs of steel channels act as templet for the diaphragm cells connecting the main cells.



CIRCULAR TEMPLET for guiding piling is swung into place by pair of skid derricks on barges.

The two skid derricks, mounted on barges, handled 9-3-B steam hammers, which were operated simultaneously on the piling. However, it was the usual procedure to have one derrick installing the piling and adding pieces to the cells, if splicing was required.

Cofferdam No. 1 consists of 38 main cells, each 47 ft. 11 in. in diameter, connected by sheet steel diaphragm cells, center-to-center distance between two main cells being 52 ft. Entire length of cofferdam is 2,104 ft., inclosing an area of about 12 acres.

Inland Steel Co. sheet steel piling was used, I-31-S, 15 in. wide, 38.8 lb. per lineal foot. Maximum penetration of sheet steel piling is 55 ft., with average penetration of 10 ft.

GOOD CONCRETE in Cold Weather

INCLOSURE of building construction by tarpaulin-covered framework during zero weather protects Purdue demonstration house at Lafayette, Ind.

PROPER PRECAUTIONS in heating aggregates and water, mixing, placing and protecting the mix in the forms, make it possible for contractors to carry on concreting during cold weather, with resultant advantages to themselves, to labor and to owners. While it is true that low temperatures retard the rate at which concrete hardens and gains strength, good results may be obtained by following the cold weather concreting technique recommended by the Portland Cement Association and suggested in the accompanying photos and notes.

Most specifications for such structures as buildings require that when air temperature is 40 deg. F., or below, concrete should have a temperature of no less than 70 deg. nor more than 100 deg. at the time of placing. In general, concrete should be maintained above 70 deg. for the first three days or above 50 deg. for the first five days after placing. When high-early-strength cement is used the requirements are usually a minimum of 70 deg. for two days or 50 deg. for three days.

It is seldom necessary to heat aggregates above 45 or 50 deg. Mixing water should not be heated above 165 to 175 deg. F.

For heating aggregates a steam-boiler is generally provided on jobs of average size to supply coils of old pipe under the aggregate piles, or steam jets of 1½-in. perforated pipe. Tarpaulins placed over the aggregates will help conserve the heat. Aggregates are sometimes piled over steel pipe in which a fire is built. Oil-burning heaters also are used for heating concrete in the mixer by injecting a hot flame into the mixer drum.

On the average job the boiler capacity should be from 2 to 2½ boiler hp. per cubic yard of concrete per hour of maximum demand, but should not be less than 50 hp. licensed for 80-lb. steam pressure.

In multi-storied buildings, heat

WOOD FRAMEWORK covered with tarpaulins protects Purdue demonstration house during construction.

STRAW COVERED STEAM PIPE protects 4-ft. concrete sidewalk at Grandville, Ohio.

FURNACE under mortar boxes supplies heat at Memorial Building, Hinsdale, Ill.

OIL-BURNING HEATER warms concrete during mixing.

may be supplied by steam or coke-burning salamanders (1 salamander per 300 sq.ft. of floor space). Holes are left in floor slabs to allow warm air to circulate (1 8x12-in. hole per 300 sq.ft. of floor area). Ventilation must be provided to guard workmen against carbon monoxide from salamanders.

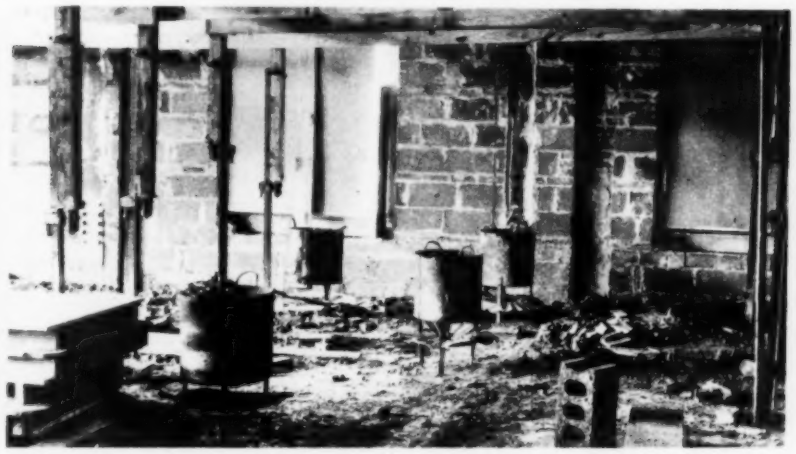
The use of salts, chemicals of other foreign materials to lower the freezing point of concrete should not be permitted. Within certain limits, however, calcium chloride may be used to accelerate the hardening and increase the early strength of the concrete.

Concrete should never be placed on a frozen subgrade because of the danger of settlement when the ground thaws. Before placing concrete in the forms, all ice and frost should be removed from inside the forms and from reinforcing steel. This is best done with live steam. In buildings a steam line should be carried up with the formwork and a hose connected for cleaning forms.

TARPAULINS are draped over forms for piers of grade separation structure on Outer Drive, Chicago.

PIPE COILS over fire are effective for heating mixing water. If sunk in pit efficiency is increased.

STEEL PIPE with fire built inside heats aggregates piled over them.



SALAMANDERS keep newly laid walk from freezing by maintaining temperature of 78 deg. F.

TRIANGULAR "CHICKEN COOPS" (in background) heated with ordinary kerosene lanterns, keep sidewalk concrete warm.

SUBGRADES are protected from freezing by straw until ready for paving.

WATER HEATER (at right) and oil-burning heater on mixer raise temperature of concrete batch.

Faster POWER

. . . THE

Three Allis-Chalmers "L-Os" pulling a Gar Wood L-10 and two Continental 7-yard scrapers. FASTER POWER enables these rigs to make more trips per shift, to move more yardage per horse power and to cut final yardage costs to new and more profitable lows.

• •

Model "L-O" and Gar Wood L-10 loading in the cut on Clarence Berg's highway relocation job on U. S. 16 near LaCrosse, Wis. FASTER POWER saves time on haul and return, enables operator to make extra trips hourly.

ALLIS-C

TRACTOR DIVI

HE WAY TO LOWER COSTS

If you're interested in tractor power that gets up on its tracks and moves dirt quickly and at low costs, investigate the FASTER POWER of Allis-Chalmers Oil Tractors. It's Faster Power because A-C design eliminates speed-robbing deadweight—tractor weight saved means extra payload gained ... Faster Power because A-C tractors have more and higher speeds; that means greater flexibility and the right speed for every task. Faster Power because A-C tractors start instantly and go right to work—no fussing with or waiting on auxiliary motors ... finally, Faster Power because A-C tractors are geared to give maximum performance in the higher speeds at which you do 90% of your work. Watch that Faster Power gain extra trips hourly over ordinary, slower-moving tractors.

LOWER IN COST, TOO Not only is A-C tractor power faster, it's Lower-Cost Power, too. The first cost is lower. The operating cost is lower because Allis-Chalmers Controlled Ignition Oil Engines operate on Diesel fuel oils and require no special lubricants. Maintenance cost is lower because Controlled Ignition eliminates the destructive vibration, the high pressures and high temperatures that cut down the normal tractor's life. Compare the performance and cost of FASTER POWER with slower-moving conventional tractors. Ask your nearest A-C dealer for the facts.

6 FORWARD SPEEDS UP TO 6.41 M. P. H. WITH THE MODEL "L-O"

INSTANT STARTING
LOWER MAINTENANCE
QUICKER PICK-UP
BETTER BALANCE

LET'S GO! ROAD SHOW, JANUARY 17-21, CLEVELAND, OHIO

S-CHALMERS
R DIVISION—MILWAUKEE, U. S. A.

Controlled Ignition
OIL TRACTORS

Pipe to Carry Sewer

Jacked Under Railroad

JACKING PIT is excavated in street along side of railroad crossing. At left is 10-ft. length of 96-in.-diameter corrugated metal pipe to be jacked.

REPLACEMENT of an old sewer outlet with a new 72-in.-diameter precast concrete pipe at a point where the line crosses under the main tracks of the D. L. & W. R. R. at Gifford and West Onondaga Sts., in Syracuse, N. Y., was accomplished without resort to expensive shoring by jacking a 20-ft. length of 96-in.-diameter, 8-gage Armco corrugated metal pipe under the tracks to serve as a tunnel to carry the 72-in. concrete sewer pipe. Open-trench methods of placing the new sewer under the railroad would have entailed support of the tracks, during construction; by shoring estimated to cost about $4,000. To avoid this expense and to prevent any possible interference with train movements, Street Bros., local contractors, decided to resort to the jacking method of providing an opening for the new sewer underneath the railroad's right-of-way. The depth of cover over the top of the pipe to be jacked was 10 ft.

The 72-in. pipe for the new sewer was cradled in concrete, with an 18-in.-thick base, reinforced with ¾-in. steel rods, and the sides extended up above the horizontal diameter of the pipe. At this point the concrete cradle was 9 in. thick. This strong reinforced cradle served also as an excellent back-stop for resistance to pressures used in forcing the corrugated pipe into the excavation. Guide, or lining timbers, 8x8 in. by 20 ft., were placed on the line of the 72-in. pipe, approximately 6 in. below the invert, and 2 ft. on each side of the center line.

The corrugated pipe, in section lengths of 10 ft. each, were placed, one at a time, on the guide timbers. Four men carried on the work of excavating the sand and gravel from within the pipe and of jacking the pipe into the opening provided for it. The bearing frame was made up of 8x8-in. timbers. This was placed against the rear of the corrugated pipe and pressures were applied, from the jacks, by other heavy timbers as shown in the photograph. To reduce friction during shoves a smooth metal shield was bolted to the top quarter of the corrugated metal pipe.

TRENCH, with concrete cradle for new sewer pipe used as back-stop for jacks, set horizontally.

INTERIOR of 96-in.-diameter Armco pipe jacked under railroad tracks to carry new sewer.

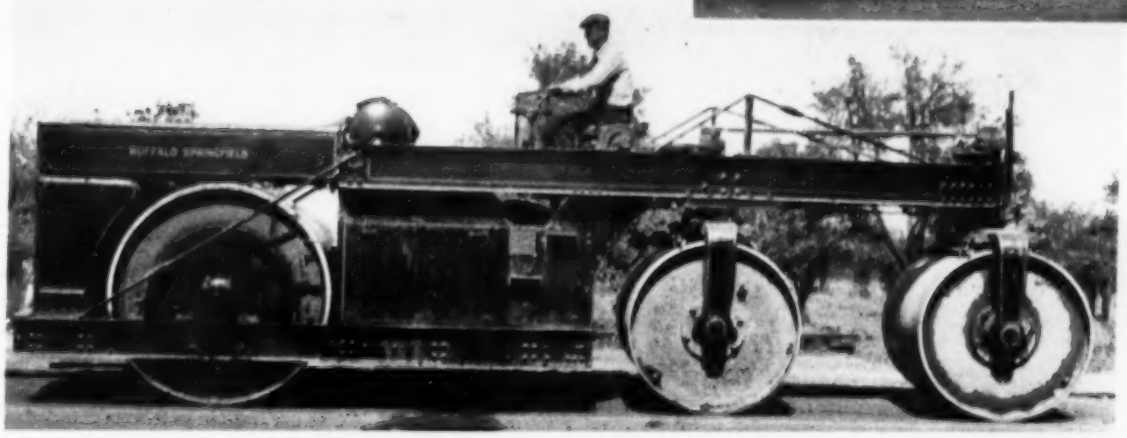
On the first 10-ft. length of corrugated pipe two 30-ton Simplex ratchet jacks were used; on the second 10-ft. pipe section the foregoing equipment was supplemented by a 50-ton Duff hydraulic jack. Jacking operations consumed 32 hr. and cost $200 for labor and supervision.

The total number of men employed on this job was 7, including a foreman, crane operator, and 5 laborers. Joseph Street was in charge for the contractor and J. McCarthy was the resident engineering inspector for the city engineering department, city of Syracuse. The entire project was controlled by Harold Keefer, assistant engineer in charge of sewer construction for the City of Syracuse.

Three-Axle Tandem Roller

Compacts Asphaltic Mix

OLD SHOULDER is cut by tractor-hauled grader to subgrade for widening strip of new pavement.



THREE-AXLE TANDEM ROLLER, weighing 13½ tons, is first of its kind to be used on Pacific Coast.

IN SEPTEMBER, 1936, the California Department of Public Works, Division of Highways, let a contract for resurfacing and widening a section of one of the state's principal highways, California U. S. Route 101. The resurfacing started at the south city limits of San Jose and extended southward a distance of approximately 10.4 mi.

The contract called for resurfacing and widening the present 20-ft. surface to a width of 30 ft., and constructing shoulders 8 ft. wide. The new surface is of asphaltic concrete, using a California asphalt of 40 to 50 penetration. The new pavement was to have a minimum thickness of 2 in. over the old, and the widened areas a thickness of 7.2 in. on 4 in. of crusher-run base. Where the pavement was placed on new base, it was laid in 3 courses, consisting of 3.2 in. of base, 2 in. of leveling, and 2 in. of Type A surface.

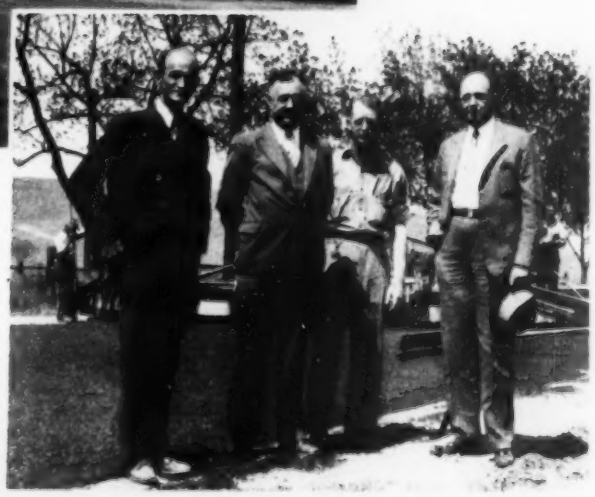
All initial rolling of the crusher-run subgrade, as well as the surfacing, was done with one of the new Buffalo Springfield 3-axle tandem rollers, the first of its kind to be used on the Pacific Coast. The California standard specifications provide that all such rolling shall be done with a 3-wheel roller having a minimum compression of 320 lb. per lineal inch.

The roller weighed 13½ tons and additional weight up to 19 tons could be obtained by loading the rolls and the ballast and sprinkling tanks with water. The construction was such that the front roll could be locked in a plane with the other rolls at the will of the operator. With the front roll locked the roller is used for smoothing out irregularities in the finished surface.

In addition to the 3-axle roller, the contractor provided two 8-ton tandem rollers for cross-rolling. To meet the requirement of the specifications that the pavement be laid in one continuous 30-ft. section, the contractor provided one of the new Schulz-Halburg finishing machines; this machine was used for laying the base and leveling courses, as well as the surface course. A Caterpillar R.D. 7 diesel tractor with Le Tourneau 8-cu.yd. carryall was used for all rough grading and heavy excavation, and two "77" Austin motor-graders for finished grading.

Jones & King, of Hayward, Calif., were the contractors, N. B. Bennett was the superintendent in charge. The work was done under the direction of John H. Skeggs, district engineer, California Division of Highways; C. F. Price was resident engineer, and G. A. Wildman acted as his assistant.

STRAIGHT-EDGING *(left)* and bump rolling surface of asphaltic concrete pavement.



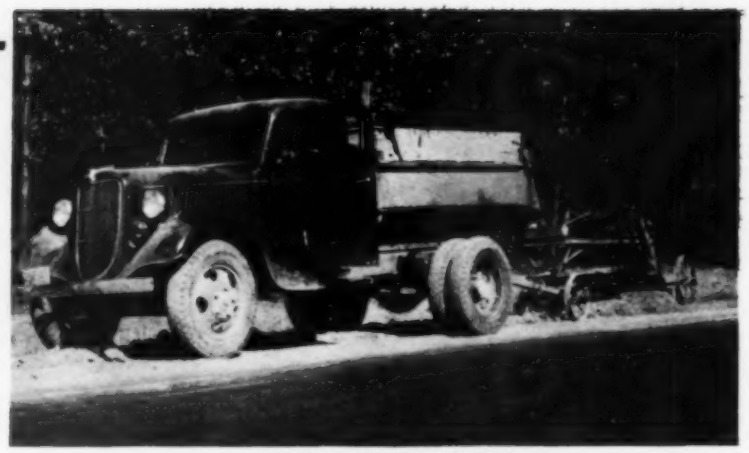
PROJECT PERSONNEL includes *(left to right)*: G. A. Wildman, assistant resident engineer; C. F. Price, resident engineer; N. B. Bennett, contractors' superintendent; and A. S. Jones of Jones & King.

FINISHING MACHINE spreads both base and leveling courses for 30-ft. paved width.

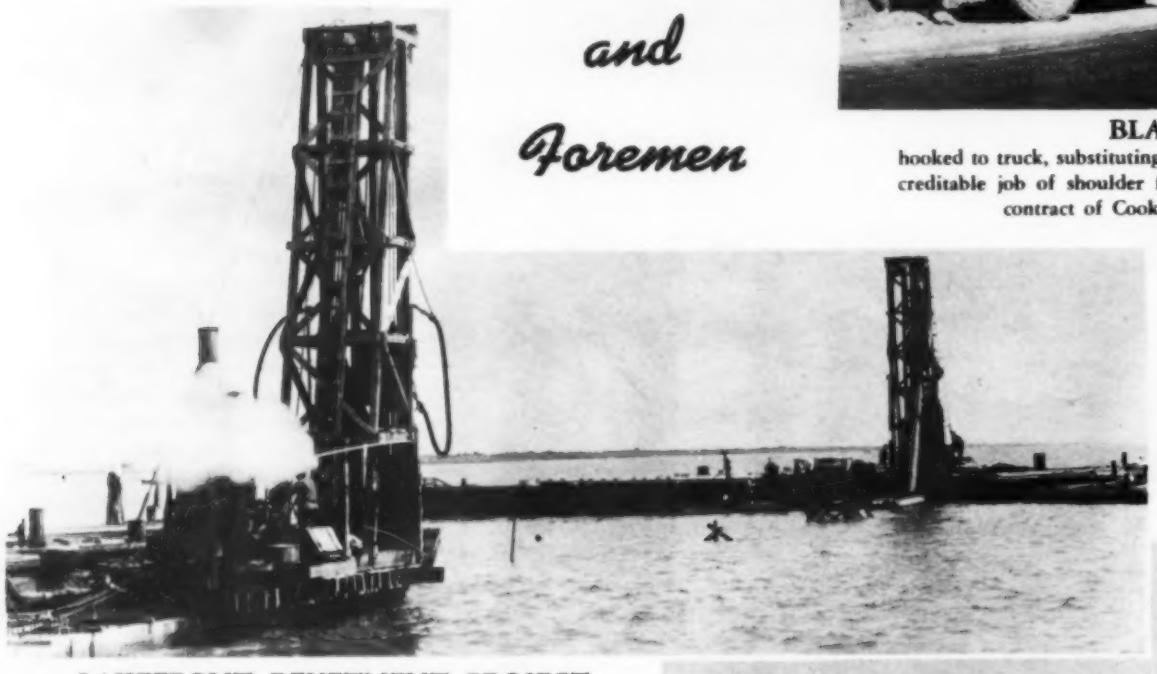
How They Did It—

CONSTRUCTION DETAILS

For Superintendents and Foremen

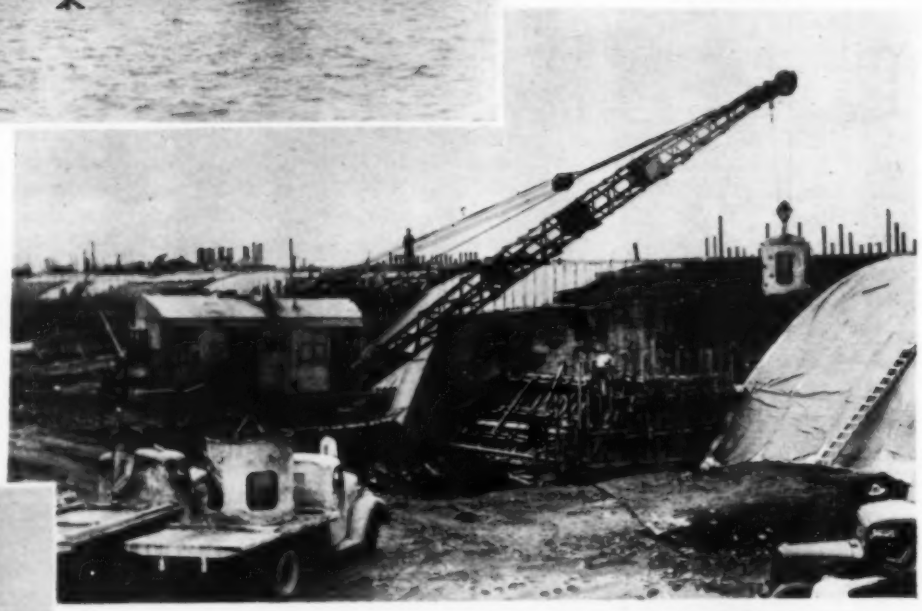


BLADE TRAILER
hooked to truck, substituting temporarily for motor-patrol grader, does creditable job of shoulder finishing on Michigan bituminous paving contract of Cooke Asphalt Paving Co., Detroit.



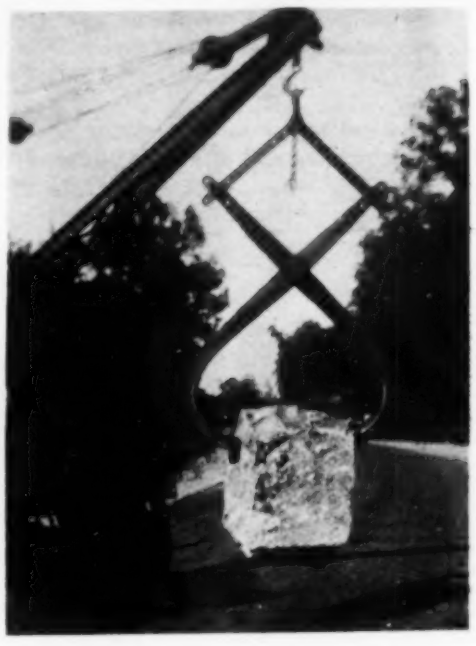
LAKEFRONT REVETMENT PROJECT
at Port Arthur, Tex., includes 7,000-ft. main bulkhead section constructed with interlocking concrete piles driven in two rows, 3¾ ft. c. to c., filled with tamped clay and capped with stepped concrete top. J. DePuy, San Antonio, Tex., contractor, uses two skid piledrivers, operating on piling already driven, each equipped with two sets of leads and two hammers to drive double line of bulkhead piles. Steel follower blocks containing six holes for reinforcing rods protect tops of piles during driving. Concrete bulkhead takes about 10,000 piles, 18x9 in. by 24 ft. long, and connects with wood pile bulkhead and earth levee extending $430,000 project to full length of 5 mi. Howard A. Trevillyan is engineer-inspector in charge for federal government.

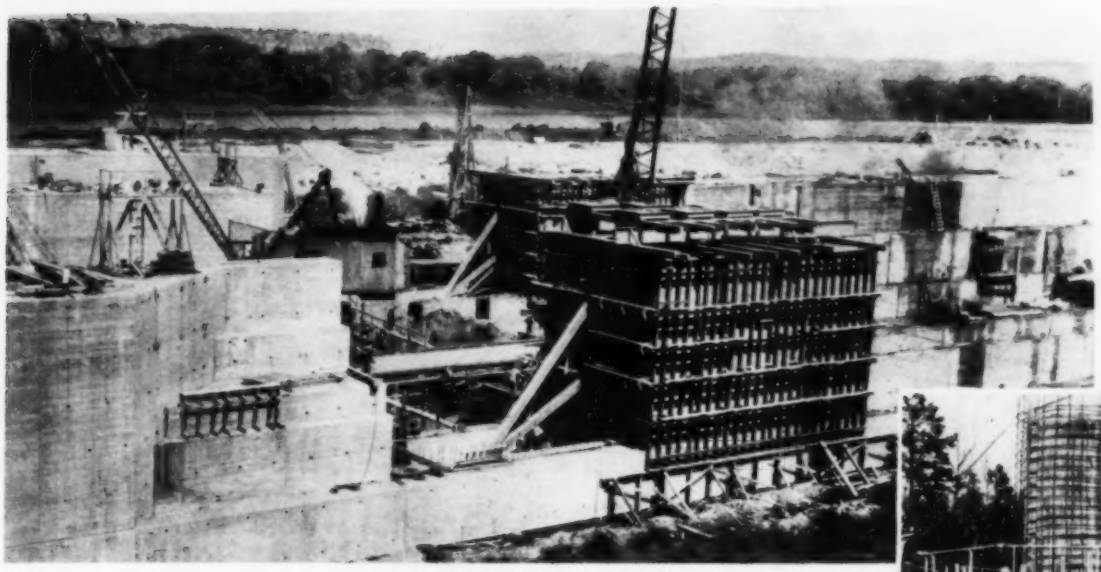
DIESEL CRANE
(below) handles 2-yd. concrete buckets from trucks to forms of tainter-gate spillway piers at Buchanan dam, built in Texas by Lower Colorado River Authority. Truck-haul of buckets to cranes is used in concreting portions of 2-mi.-long dam not reached by cableway.



INSPECTION SHAFT
(left) 20 ft. in diameter, lined with steel sheetpiling, is driven to depth of 95 ft. to expose bedrock for examination at proposed site of Gilbertsville dam, Tennessee Valley Authority project on Lower Tennessee River.

ROCK TONGS
(right) of homemade variety are made of 1-in. stock with 2½x2½x½-in. angle-iron welded on one side as stiffener. Device made in blacksmith shop, from plywood templet, is operated from truck-crane with motor driven winch.—*Photo from* S. L CARPENTER, *Luray, Va.*



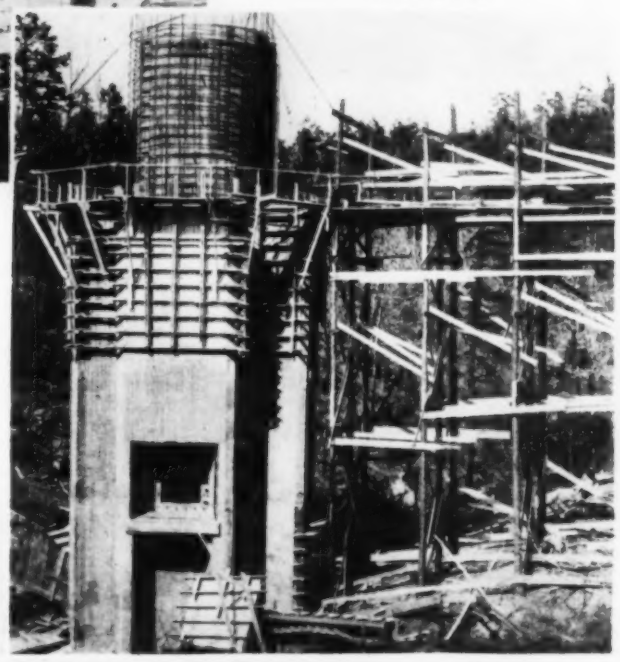


BRACING

holds end bulkhead of form for Lock No. 3 on Mississippi River built by Spencer, White & Prentis, Inc., at Red Wing, Minn. Steel H-beam runs vertically from anchor on tunnel floor to top of form. Attached angles form seats for timber braces to bear against. Timber braces are held on floor by special anchors. H-beam rests directly against steel wale which, in turn, rests on wood joists of master form panels.

POLE TRESTLE

(below) enables concrete carts to reach intake tower erected on upstream slope below spillway level of Little Rock, Ark., water supply dam, described elsewhere in this issue. Tower rises above inlet end of 32.4-mi. pipe line running to city's distributing reservoir. Wood panel forms are re-used several times on outside of tower, built as part of his subcontract by William Peterson, Little Rock, for L. O. Brayton & Co., general contractor, Dyersburg, Tenn.



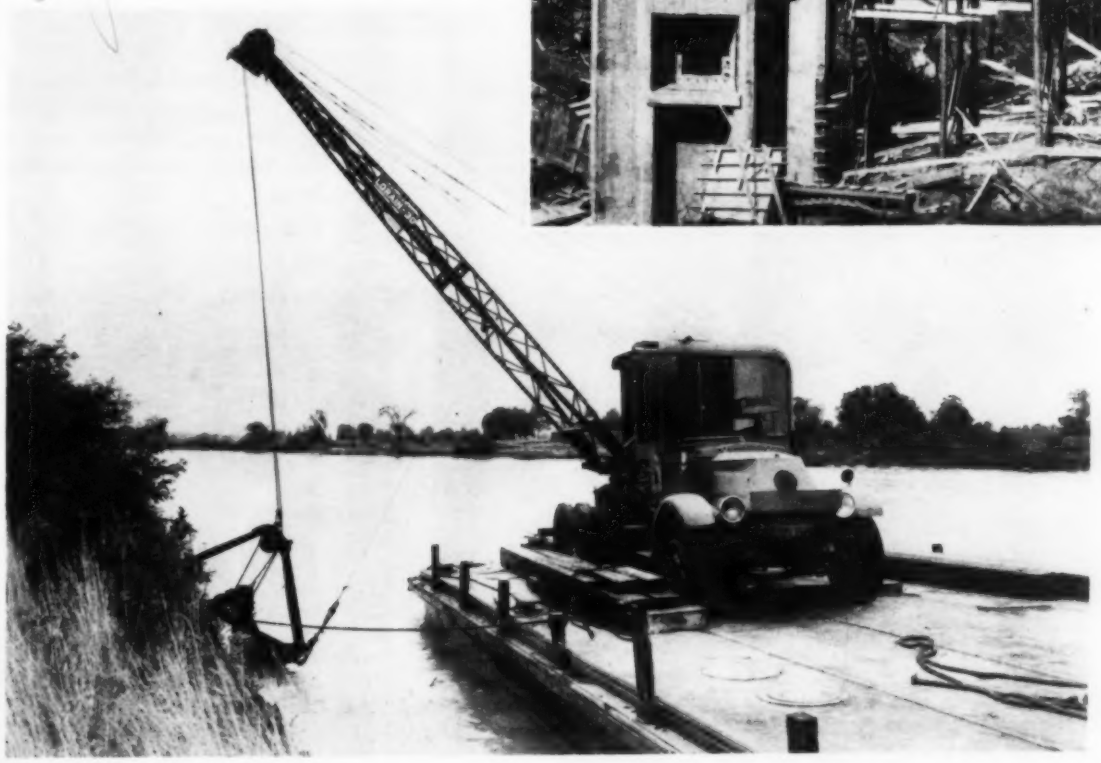
WANTED—
Photos of Details

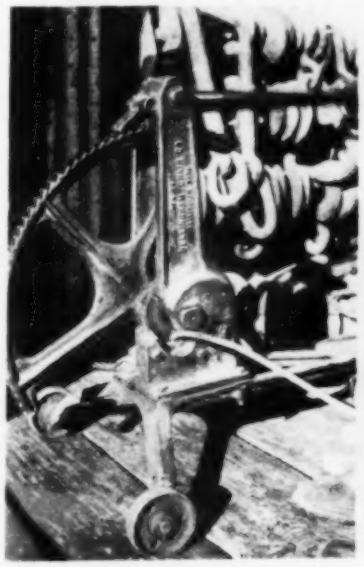
The Editor of CONSTRUCTION Methods and Equipment wants photographs or sketches illustrating interesting DETAILS of method or equipment and will pay for those he finds acceptable for publication.

Hasn't your job produced some DETAIL that might be illustrated on this page? Send along a picture of it; we'll return it promptly if we can't use it.

BANK GRADING

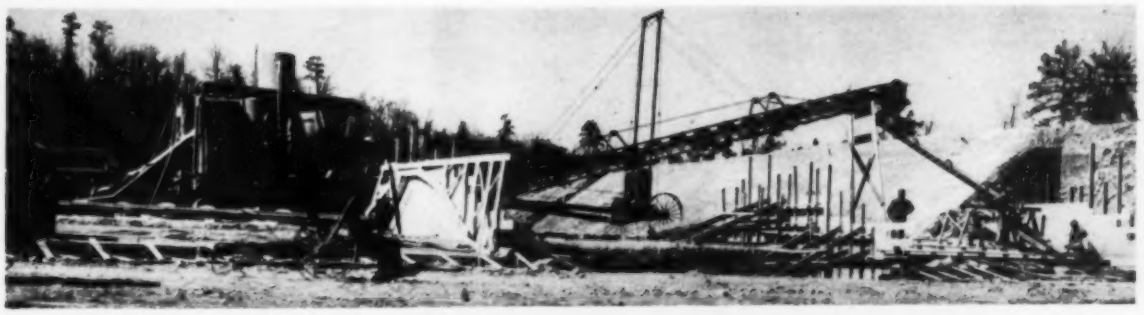
(right) prior to placing of riprap at point east of Lake Oneida, near Syracuse, N. Y., is done by barge-mounted Lorain truck crane, one of eighteen owned by N. Y. State Highway Department. After trimming clay bank clamshell on crane is changed to orange-peel bucket for placing riprap.





WIRE ROPE

is conveniently and quickly cut by this wheel and ratchet device on Grand Coulee dam.



PORTABLE BELT CONVEYOR

66 ft. long handles concrete from paving mixer to points which cannot be reached by direct chuting. William Peterson, Little Rock, Ark., subcontractor on concrete structures of Little Rock water supply dam for L. O. Brayton & Co., Dyersburg, Tenn., general contractor, uses conveyor in this case to reach cutoff wall of spillway weir. Job is described elsewhere in this issue.

Pneumatic-Tired Truck Wagons Move 1,500,000 Cu. Yd. Into

IMPERVIOUS CENTRAL PORTION of rolled earthfill dam is placed between dikes of more pervious material and is spread in 8-in. layers for compaction by sheepsfoot tampers.

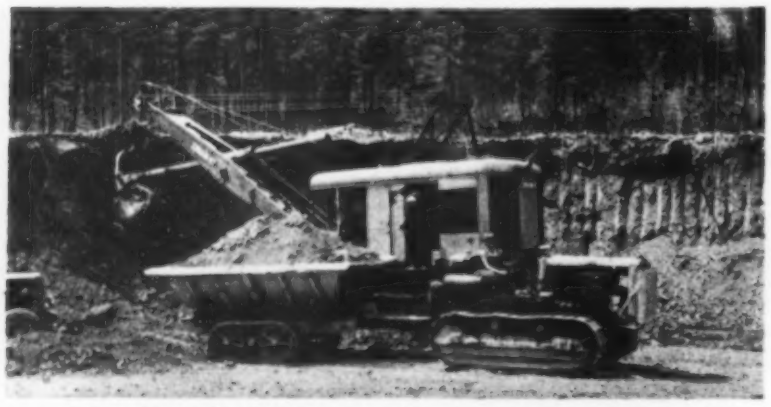
ROLLED EARTHFILL DAM

PNEUMATIC-TIRED TRUCK TRAILERS operated by L. O. Brayton & Co., Dyersburg, Tenn., contractors, and Clark, Kearney & Stark, Cape Girardeau, Mo., subcontractors, moved the bulk of the material required to give a compacted volume of more than 1,500,000 cu.yd. in the rolled earthfill embankment of Little Rock, Ark.'s new water supply dam on Alum Fork of the Saline River, located in the hills more than 30 mi. to the west of the city. Two types of excavators loaded the wagons, the general contractors operating two 2½-yd. draglines in a borrow pit to feed sixteen truck trailers while the subcontractors used a 2-yd. shovel in a second borrow pit to serve a much smaller fleet of earth-moving vehicles. The truck trailers, mounted on large pneumatic tires, traveled at high speed between the borrow pit and the dam on both loaded and empty hauls, an average one-way distance of about 3,500 ft. To transport material from the second borrow pit, about 800 ft. from the center of the dam, the subcontractors maintained continuous operation with a hauling fleet comprising one truck trailer and two tractor-drawn track-wagon units.

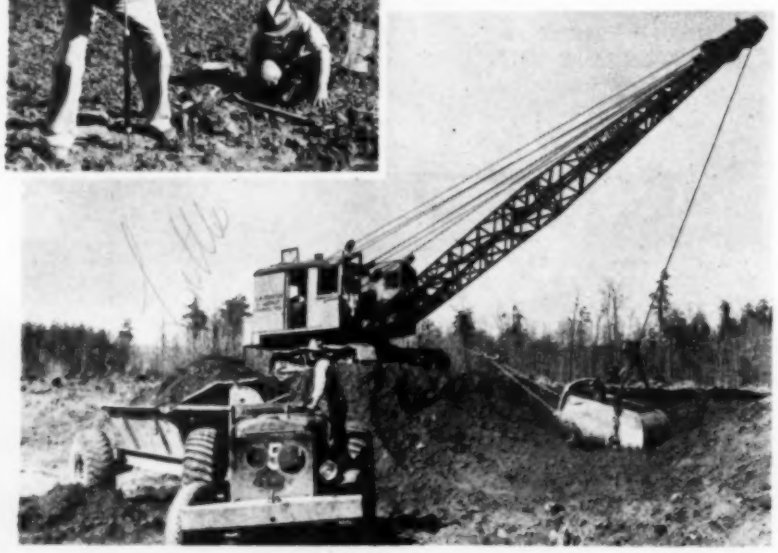
Working Schedule — L. O. Brayton & Co., the general contractors, operated three 8-hr. shifts per day 7 days a week, with ½ hr. in each shift reserved for refueling, greasing and oil change, leaving 22½ hr. in each day for hauling material from the borrow pit to the dam. The two dragline excavators and the fleet of sixteen truck trailers averaged about 6,600 cu.yd. of compacted fill per day of 22½ hauling hours. On maximum days this equipment moved nearly 12,000 cu.yd.

Using the 2-yd. power shovel and a smaller fleet of earth-moving units for the shorter haul, Clark, Kearney & Stark operated two full 8-hr. shifts per day, a total of 16 hauling hours, and managed to place as much as 3,500 cu.yd. of compacted fill material in this time. The average volume (of compacted earth fill in the em-

SUPPLEMENTING TRUCK TRAILERS, 12-yd. carrier scraper, end-dump earth-moving trucks and tractor-drawn track-wagons place soil from borrow pits in central portion of dam. Earth in foreground is in process of being compacted by sheepsfoot rollers.



LOADING OPERATION at second borrow pit is speeded by 2-yd. shovel working bank about 15 ft. high.



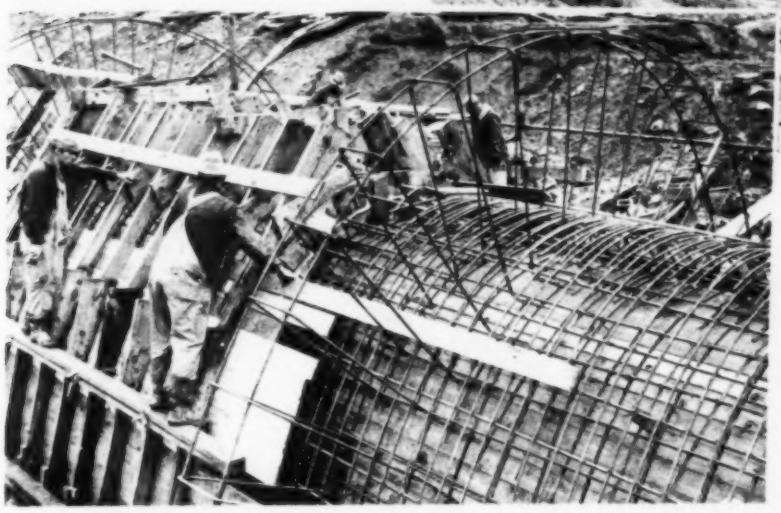
PLASTICITY NEEDLE TEST *(inset)* of compacted soil in earthfill dam gives instant check on density being obtained in construction. Resistance to penetration by plasticity needle is indicated by calibrated Proctor instrument for comparison with soil-characteristics curves (previously plotted for this soil by laboratory), giving dry weight and per cent of voids in soil for various resistances. **AT BORROW PIT,** 2½-yd. dragline *(above)* loads truck-trailer having water-level capacity of about 8 cu.yd.

bankment) moved by this outfit per day was about 3,000 cu yd.

Before starting work on the rolled earthfill embankment, the same subcontractors removed more than 100,000 cu.yd. of rock excavation from the spillway, diversion channel and dam foundation. The quantities involved in these operations were: spillway, 81,600 cu.yd.; diversion channel, 10,500 cu.yd.; dam foundation, 11,150 cu.yd.

Dam Contract—A work order was issued to L. O. Brayton & Co. on Sept. 18, 1936, following the award of the contract to this firm on Sept. 9. The Burns & McDonnell Engineering Co., Kansas City, Mo., acted as agent for the city of Little Rock in all preliminary studies and investigations, in designing the entire water supply system and writing the contract and, finally, in supervising the construction. Under the dam contract it was proposed to build a rolled earthfill embankment rising 115 ft. above stream bed, 600 ft. wide at the base and 20 ft. wide at the crest, a concrete diversion conduit, a concrete spillway and a concrete intake tower connecting with a 32.4-mi. pipe line leading to the city. Manufacture of the precast steel-cylinder reinforced-concrete pipe for this line was described in CONSTRUCTION Methods and Equipment, September, 1937, pp. 56-58, while the actual construction of the pipe line was noted in the succeeding issue, October, 1937, pp. 48-50. Including the concrete spillway, located in a natural saddle at the east end of the dam, the entire dam has a length of 2,800 ft.

FAST-TRAVELING TRUCK TRAILERS dump loads of clayey soil in central portion of dam to be spread by tractor-bulldozers. Note condition of soil in right foreground following compaction by sheepsfoot tamping rollers.



REINFORCING STEEL and wood forms for diversion conduit are erected by concrete subcontractors' crew.

DIVERSION CONDUIT carries upstanding cutoff collars at frequent intervals. In foreground, dragline bucket is stripping overburden to bedrock under central portion of dam. Portable compressor furnishes air to pneumatic tamper being used at left to tamp earth around rock outcrop. Tampers of this type are used all along conduit and at other points where rolling is impossible.

Preliminary Investigations—To determine which of the available soils near the site would be most satisfactory for compaction in a rolled earthfill dam, the engineers dug 989 test pits by hand and found about 25 different soils in quantities sufficient to justify their consideration. Using the laboratory method developed by R. R. Proctor, of Los Angeles, these soils were tested for compaction characteristics, bearing strength and percolation rate. Results of these tests definitely grouped the soils in three general classifications, and the characteristics of these three classifications served as the basis of field control during construction of the dam.

BACKFILL around diversion conduit receives same treatment as earthfill dam, being spread by bulldozers in 8-in. layers and compacted by sheepsfoot tamping rollers. Note counterfort wing walls at inlet end.

Earth Embankment — To assure the stability of the structure under the worst possible (completely saturated) condition, soils were placed in the embankment at a moisture content which permitted sufficient compaction to give a saturated soil plasticity needle reading of at least 300 lb. per square inch. Soils containing the highest percentage of clay were placed in the central half of the base of the dam at moisture contents between 15 and 19 per cent. In the upstream and downstream portions of the dam and in the higher elevations of the central portion, the engineers permitted the contractors to place soils containing a greater proportion of sand at moisture content ranging from 11 to 19 per cent.

In the embankment, soil was spread with bulldozers in 8-in. uncompacted layers, moistened and disked, if necessary, and rolled fourteen times with sheepsfoot rollers. This method of compaction resulted in dry weights in the fill ranging from 110 to 124 lb. per cu.ft. As built, the dam is nearly one-third more dense than the native hills around it.

Foundations — Under the dam is a foundation of shale and sandstone, overlaid with 1 to 20 ft. of sandy clay and gravel. This overburden was sufficiently impervious (with provision of necessary cutoffs in the grav-

COPPER FLASHING seals joints between abutting slabs in reinforced-concrete apron.

DIVERSION CHANNEL and trench for conduit construction are excavated by 2-yd. shovel before it starts work in borrow pit. Granular fill material has been placed in upstream toe to retain impervious central core of embankment.

WOOD TEMPLET guides concrete finishers in completing Ogee section of weir.

el strata) to serve as a foundation for the dam, but laboratory tests showed that as much as 2 ft. of settlement under the weight of the dam would occur in the material at points of maximum depth. As this amount of settlement might adversely affect the stability of the dam, the engineers decided to strip the foundation under the central portion of the dam to bedrock.

Concrete Structures—Appurtenant works requiring between 11,000 and 12,000 cu yd. of concrete were built for the general contractor by William Peterson, Little Rock, Ark., subcontractor. The first of these structures was a reinforced-concrete diversion conduit of horseshoe shape, 10 ft. in diameter and about 500 ft. long, constructed through the west end of the dam for diversion of average normal floods during construction. Upon completion of the dam, the diversion conduit will be plugged with concrete at the upper end and will serve thereafter to provide access to a system of pipes extending upward into the body of the dam whereby the line of saturation may be observed.

More than 8,000 cu.yd. of concrete went into the weir-type spillway, which has a crest length of 300 ft. at an elevation 15 ft. below the crest of the earth embankment. This volume of concrete provided for construction of an apron extending 150 ft. upstream from the weir and for the lining of a channel carrying the water down a 25 per cent slope to a small side canyon which re-enters Alum Fork about 1,000 ft. below the dam. Methods of construction on the diversion conduit and spillway, as well as on a reinforced-concrete intake tower, are indicated by accompanying photographs.

Administration—Total cost of new construction for Little Rock's improved water supply amounts to about $3,500,000. The dam contract was awarded to L. O. Brayton & Co., Dyersburg, Tenn., at a bid price of $921,726. Alvin G. Hall, general superintendent, directs the entire dam construction program for the general contractors, including the coordination and planning of the work of the subcontractors. Excellent construction management has resulted in splendid progress and early completion of the project.

Engineering design and supervision of the entire project are the responsibility of the Burns & McDonnell Engineering Co., Kansas City, Mo. Marion L. Crist, resident engineer, represents this firm in Little Rock and is in full charge of field engineering and construction.

ADJUSTABLE DRILL on special tubular-frame carriage sinks blast holes for rock excavation in spillway, where more than 80,000 cu.yd. of rock has to be removed.

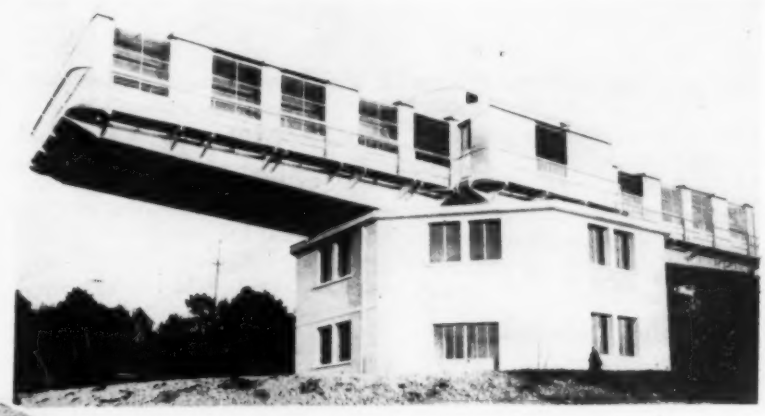
CONCRETE PLANT, here engaged in building reinforced-concrete apron upstream from spillway weir, includes batcher bins and steam crane, in background, and 27-E paving mixer, spotted to spread concrete over reinforcing steel in foreground.

JOB ODDITIES

A MONTHLY PAGE OF *Unusual Features of Construction*

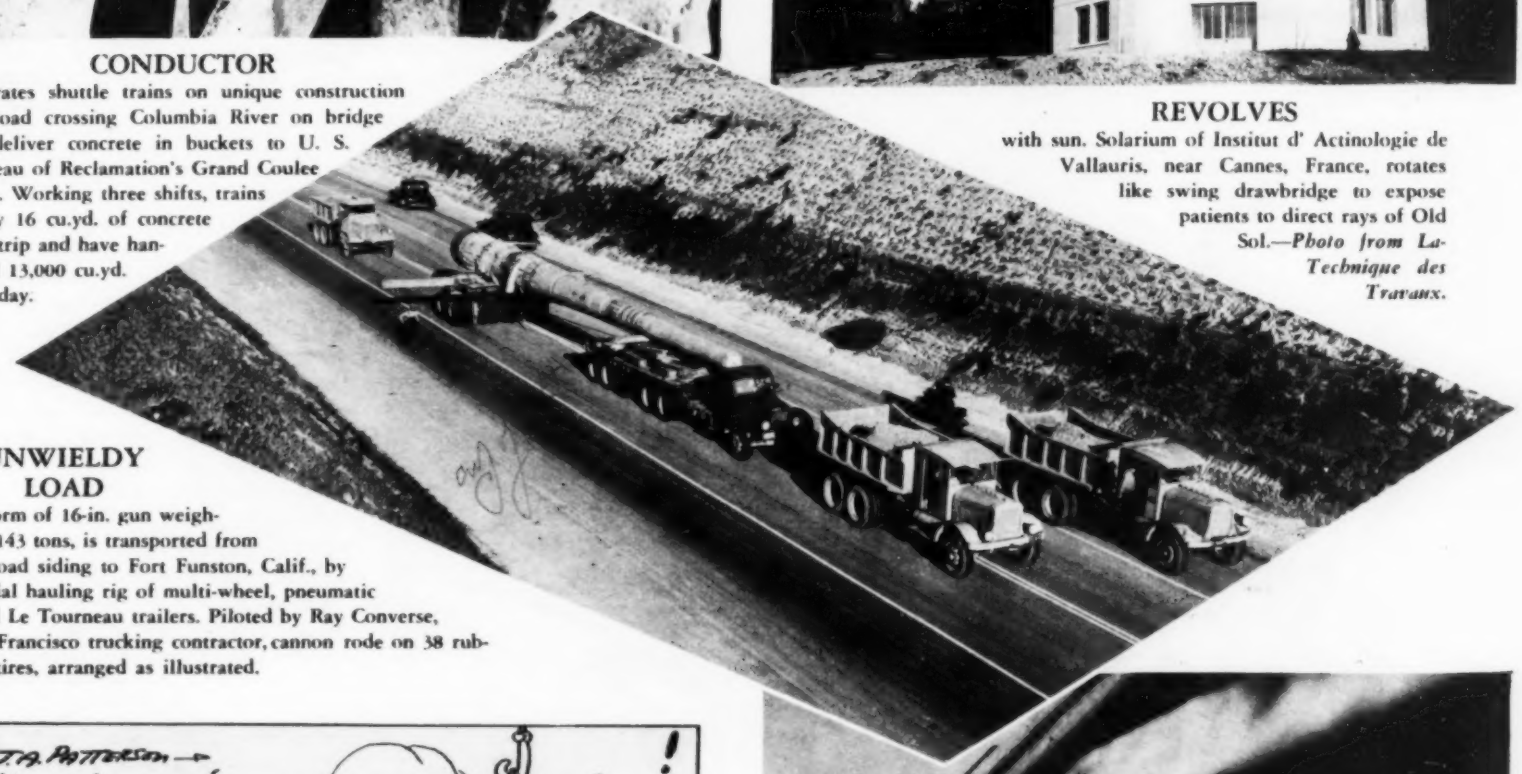
CONDUCTOR

operates shuttle trains on unique construction railroad crossing Columbia River on bridge to deliver concrete in buckets to U. S. Bureau of Reclamation's Grand Coulee dam. Working three shifts, trains carry 16 cu.yd. of concrete per trip and have handled 13,000 cu.yd. per day.



REVOLVES

with sun. Solarium of Institut d' Actinologie de Vallauris, near Cannes, France, rotates like swing drawbridge to expose patients to direct rays of Old Sol.—*Photo from La Technique des Travaux.*



UNWIELDY LOAD

in form of 16-in. gun weighing 143 tons, is transported from railroad siding to Fort Funston, Calif., by special hauling rig of multi-wheel, pneumatic tired Le Tourneau trailers. Piloted by Ray Converse, San Francisco trucking contractor, cannon rode on 38 rubber tires, arranged as illustrated.

"Mr. Murdock's been expectin' you, but I believe he just now went down to the ground floor!"

ROBIN'S NEST

is built between steel cross-brace members in lower boom of Bucyrus-Erie clamshell crane operated by A. E. Bounsall, of Kenosha, Wis., on super-highway contract between Chicago and Milwaukee.

Planning and Plant for

TWENTY-FOURTH OF A SERIES OF ARTICLES

HEAVY CONSTRUCTION

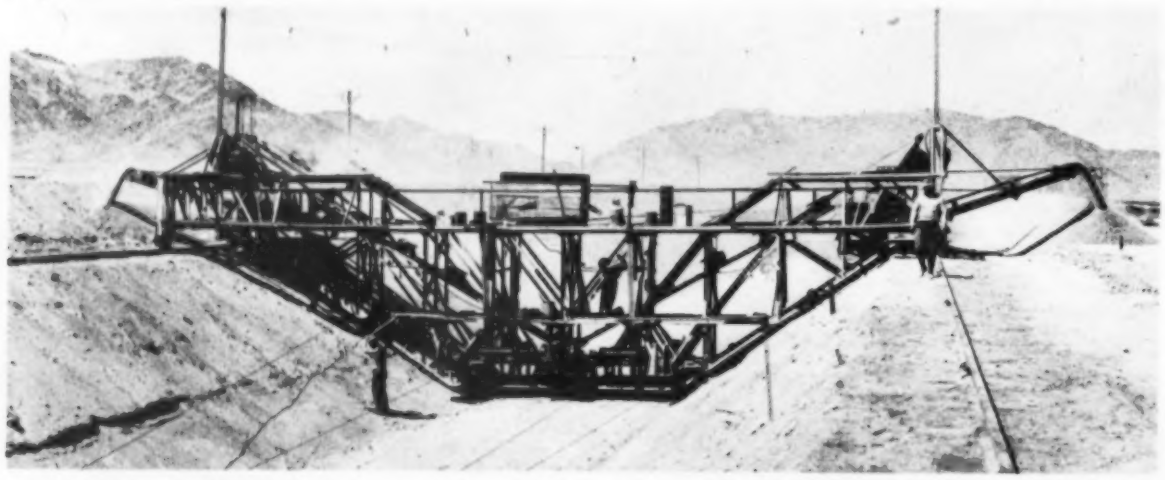
Principles and Practices of Job Layout and Selection and Use of Equipment

By ADOLPH J. ACKERMAN and CHARLES H. LOCHER
Construction Engineer *Construction Consultant*

• 24 •
Canals, Tunnels and Penstocks

A BRIEF DISCUSSION covering the canal and tunnel operations on such Western projects as the All-American canal and the Colorado River aqueduct provides valuable information on the most up-to-date methods and equipment by which new standards of construction efficiency, speed and economy have been attained.

LARGE DRAGLINE with 12-cu.yd. bucket excavating All-American canal.



EXCAVATING FINISH CUT for small canal on Colorado River aqueduct with special trimming machine.

Canals

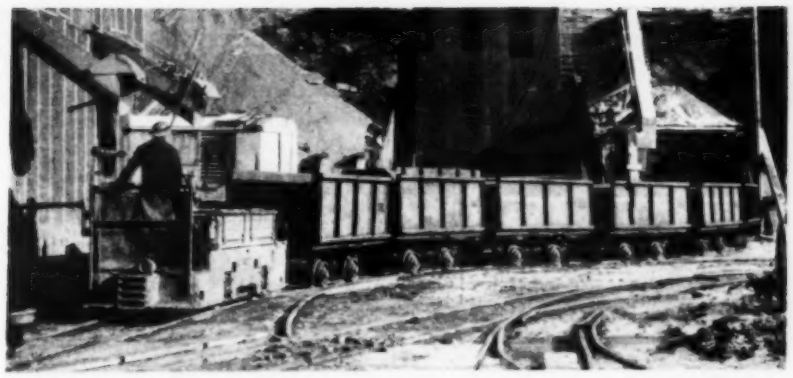
On the All-American canal, 65,000,000 cu.yd. of sandy earth are being moved by the most modern large capacity draglines handling 12-yd. buckets on 175-ft. booms. The machines, each capable of moving 500,000 cu.yd. per month, are used primarily to excavate down to rough finished lines, or subgrades, and the final trimming is done by bulldozers and other smaller tools.

The canals of the Colorado River aqueduct are of great interest because of the ingenuity which was displayed in their construction, and because canals of these dimensions are more frequently found in other parts of the country. The procedure there was first to make a rough cut with a dragline to within 6 or 12 in. of final grade. The sizes of the draglines on different sections of the canals varied from 2 to 6 cu.yd. Great care was taken to prevent overcutting, because the subgrade serves as a base for the concrete lining and has to be stable. Final trimming was done with special trimming machines, of which those invented by Jahn & Bressi and Clyde W. Wood have advanced canal construction to a new standard of performance. This machine, shown in one of the illustrations, has a rigid steel frame which moves forward at the rate of 1 ft. per minute — on parallel rails set 61½ ft. apart on the canal banks — and in one operation it cuts directly to line and grade, leaving the canal ready for concrete. The digging is done by a chain of special 1-cu.ft. side-digging buckets which feed to short conveyor belts designed to dump the trimming excavation as windrows on the canal banks. The buckets travel at a rate of 28 ft. per minute and are held to exact line and grade by rollers mounted on the chain and running in guide channels. The machine weighs about 50 tons and is propelled by a hoist mounted on the frame and reeved to a cable anchorage attached to a bulldozer which is kept spotted some distance ahead.

Lining of Canals

For placing the concrete lining, Mr. Wood developed an ingenious paver which places a 6- to 8-in. thickness of concrete in a continuous operation to exact line or grade. The paver has a wheel-mounted steel frame, similar to that on the trimming machine, which supports a sliding steel slip-form conforming to the profile of the canal lining. At the top is a runway on which a small hopper car runs forward and back with a charge of concrete and distributes the concrete as required into vertical slots which feed the concrete to the under side of the slip-form. The form is equipped with tubular vibrators which compact the concrete and prevent air pockets. Two standard road paver type of mixing units, traveling along the canal bank, charge the hopper car and the full width of the canal is placed at one time. A separate platform is mounted at the rear of the canal paver to support the men who do the hand troweling. The paver moves forward at a rate of 1 ft. per minute, and up to 944 ft. of pave-

CONCRETE PAVING MACHINE places canal lining.



ELECTRIC LOCOMOTIVE and muck cars used on Fort Peck tunnels.

TUNNEL MUCKING MACHINE of Conway type, front view.

ment were placed and finished in one 2-shift day by one machine. The average day's run was about 500 ft. of canal which required placing 700 cu.yd. of concrete.

Conduits

Next to the canal construction, the cut-and-cover conduits are of interest. These are designed for a low head and are the equivalent of a canal with a cover over it. Most of this work is done with steel forms and traveling concrete placing units, with the completed invert kept well in advance and the arch being placed in about 70-ft. lengths. The reinforcing steel for some of these conduits is made up in cages, in advance, to minimize the time required in setting up the forms and placing concrete. These operations became standardized into speedy and efficient routines.

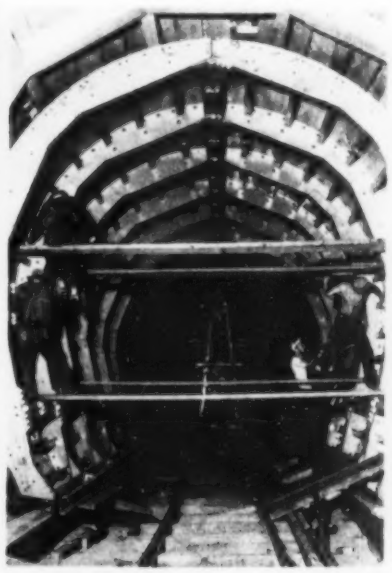
Tunnel Driving

The driving of tunnels is a highly specialized technique which requires not only extensive experience but also a comprehensive understanding of the geologic conditions which may be encountered. If these can be properly analyzed so that preparatory work will be adequate and the correct plant selected, then the rest of the job is largely one of organization and management.

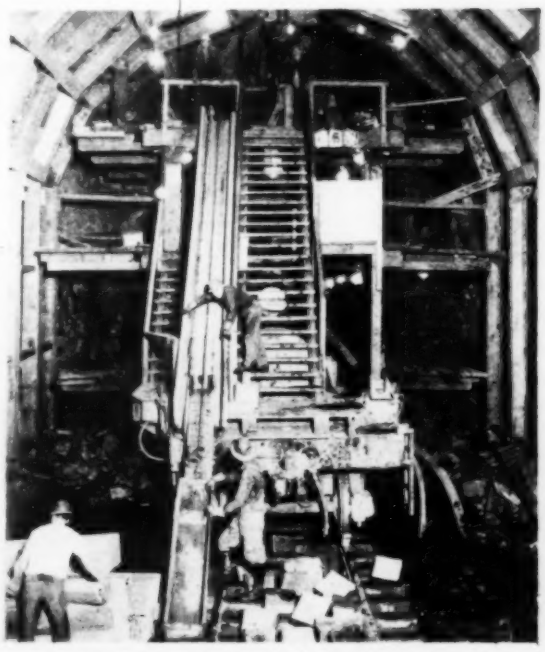
Among the older methods, the heading and bench method of mucking and drilling was considered very efficient, because drilling could proceed on the heading while the bench was being mucked, and there was greater continuity of operation in both procedures. Another early method which was considered almost standard, particularly in the larger tunnels, consisted of first driving a pilot tunnel and enlarging later after the pilot was completed. Both of these methods have been displaced in the most recent projects by the full heading method of intermittent driving and mucking, and this procedure has generally been found to be more efficient and economical.

On a simple, dry tunnel job the rate of progress is essentially a function of the size of the tunnel and location of the portals. The nature of the rock, of course, is of primary concern, and if there is a tendency for considerable overbreak the yardage may become substantially greater than was originally estimated. Where the portals are far apart and it is necessary to increase the speed of driving, the tunnel is attacked at a number of other points through vertical shafts or side adits, if these can be reasonably short, or in some cases, a smaller parallel pioneer bore, about 10x10 ft. square, is driven, through which the main tunnel can be attacked from various points. Such pioneer bores also have a special utility value in handling ventilation and drainage.

TIMBER LINING in tunnel through broken rock.



PORTABLE STEEL FORM for placing concrete tunnel lining.

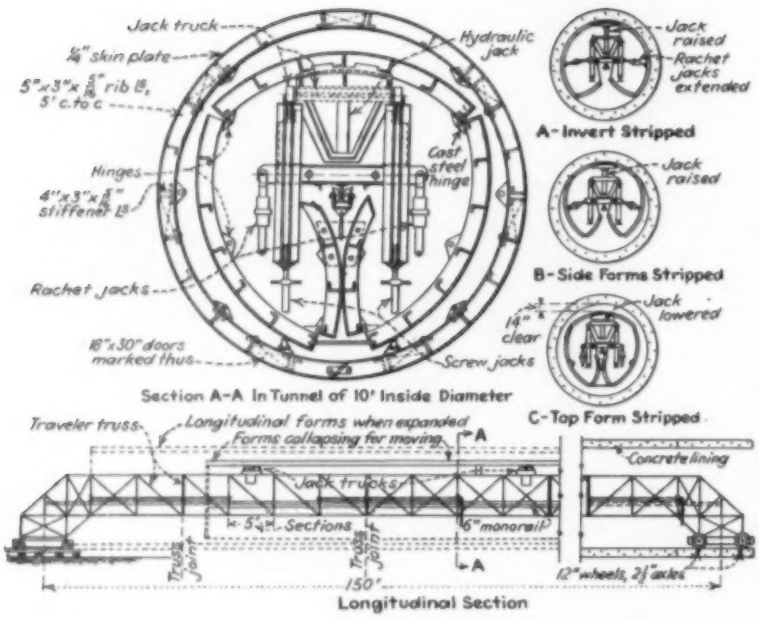


PORTABLE DRILL carriage and working platform (rear and front views) used for drilling full-face heading on Parker dam diversion tunnels.

The great number of different contracts on the Colorado River aqueduct and the large amount of tunneling done on that project have provided a testing ground for different methods and ideas which have finally been worked down to rather standardized procedures, representing notable advances in equipment and methods. Most of the tunnels are 18 ft. in diameter and were excavated by the full face heading method.

Drilling and Mucking

For drilling, heavy drills were employed, with power feeds and independent drill rotation. The drills were mounted on special portable carriage assemblies or "jumbos," which allowed more drills to be put into service on the full face prompt



METHOD OF HANDLING steel tunnel forms for lining sections 70 ft. long in one pour.

ly after mucking had been completed. The portable drill carriage eliminated the need for scaffolding and loss of time incident to setting up scaffolds. Four to six drills were used and they drilled the 25 to 60 holes 6 to 12 ft. deep required per round in from 2 to 3½ hr. For a single heading about 1,500 cu.ft. per minute of air was required for drilling, the air being delivered from the compressor house at the adit through 6-in. pipe. The drill shops, also located at the adits, were usually equipped with modern forging and automatic tempering machines.

As a rule, 25 to 40 per cent dynamite was used, which averaged about 3½ lb. per cubic yard of solid rock. The job of handling the explosives, including storing, protection against freezing and proper layout of shots and firing diagrams, requires special knowledge and experience. Some small shovels were used for mucking but an 18-ft.-diameter tunnel is somewhat tight for a tunnel shovel, and in all but 3 of the 54 headings Conway muckers, a combination loader and short conveyor unit, were employed. Where it formerly took 8 hr. to clean out a 10-ft. round, only 2½ hr. were required on the average for this operation.

Hauling of Muck

Most transportation of muck was by electric storage battery locomotives of 6 to 8 tons capacity, or combination battery and trolley locomotives. They hauled from 6 to 8 cars per train, the cars having capacities of 4 to 6 cu.yd. The better ones were of steel and equipped with roller-bearing wheels.

One of the most important operations to assure rapid transportation and a minimum loss of time is efficient car switching. It is important to have an empty car "standing by" as near as possible to the mucking machine and to remove the loaded cars promptly. One of the early devices for interchanging cars was known as a "cherry-picker," which lifted an empty car off the track and moved it up or sidewise so that the loaded car could be passed out and the empty set adjacent to the mucker. The "cherry-picker" consists of a small air-operated hoist mounted on a movable trolley crane which is shifted as necessary in handling the cars. Another device, somewhat more

Colorado River Aqueduct
TUNNEL DRIVING PRICES AND PROGRESS

	Length, Ft.	Contract Price, Per Ft.	Best Day's Progress, Ft.	Best Month's Progress, Ft.	Avg. Ft. Excavated Per Month
1. Copper Basin No. 1	705	$97.00	30	649	588
2. Copper Basin No. 2	11,570	97.00	54	1,084	656
3. Whipple Mountain	32,240	81.00	55	989	693
4. Iron Mountain, East	23,645	94.00	40	747	474
5. Iron Mountain, West	16,200	105.00	47	1,027	664
6. Coxcomb	17,800	91.00	38	741	612
7. Cottonwood	20,100	92.00	45	923	609
8. Valverde	38,000	84.00	36	595	249
9. East Coachella	96,600	81.00	48	843	548
10. 1000 Palms No. 1	16,050	81.00	51	1,101	543
11. Seven Palms	16,730	81.00	54	942	600
12. San Jacinto	68,850	242.00	43	767	165

elaborate, is known as the "grasshopper," which is a long truss frame on which the empties are stored in an overhead track and the loaded cars pass out underneath, the empties moving forward and down a short ramp to the mucker as required. One of the best devices, especially popular on the Colorado River aqueduct, was known as the California switch. It consists of a short double-track assembly, completely welded into a unit with frogs and switches, and this slides along the top of the single main track. The ends of the rails are tapered to fit the main track so that cars can travel over the California switch and to and from the main track without difficulty. This switch is kept close behind the mucker; on one side the loaded cars are passed out while empties promptly move forward to the mucker from the other siding.

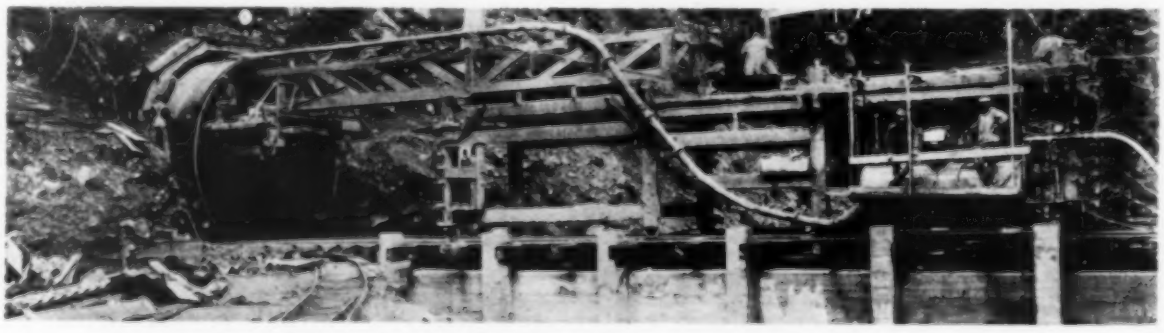
One of the most recent developments in car-loading methods is known as the Dixon conveyor, which consists of a long belt elevated sufficiently to allow a complete train to be stored under the belt and the cars move forward as they are loaded. The belt itself is loaded by a standard Conway mucker. The front end of this conveyor unit is also equipped with a drill carriage, and by thus combining the carriage with the mucking unit, the loss of time due to interchange of units is eliminated. It seems best suited to "dead" rock which does not fly very far or produce a lot of random mucking. This conveyor, like the grasshopper and cherry-picker, requires an extra set of tracks.

In removing muck through short vertical shafts it is customary to lift the cars and dump them at the top, whereas in deep shafts the cars do not come to the surface but are dumped into a hopper and the muck is transferred into skips which are hauled to the surface for disposal.

TUNNEL LINING MACHINE of double Pumpcrete type, showing belt conveyor loader at rear for charging concrete mixed in adjacent traveling mixing unit.

Ventilation and Drainage

A standard item required in a tunneling layout is the ventilating system. On the aqueduct, about 10 to 15 min. were required to clear the heading of smoke. This was done with a reversible air system which sucked out the smoke and then blew



PNEUMATIC CONCRETE PLACING unit of Hackley type, showing pipe line and tunnel forms.

in fresh air through a 22-in. metal vent pipe which was carefully gasketed to prevent leakage.

Ventilating ducts of the collapsible canvas type are especially useful near the headings where they can be readily dismantled and erected depending upon blasting conditions.

An item which sometimes assumes most serious proportions when ground water is encountered is the problem of drainage. This may lead to construction of separate pumping chambers or even parallel pilot tunnels located at a somewhat lower elevation so that the drainage of the main tunnel can be diverted or pumped out.

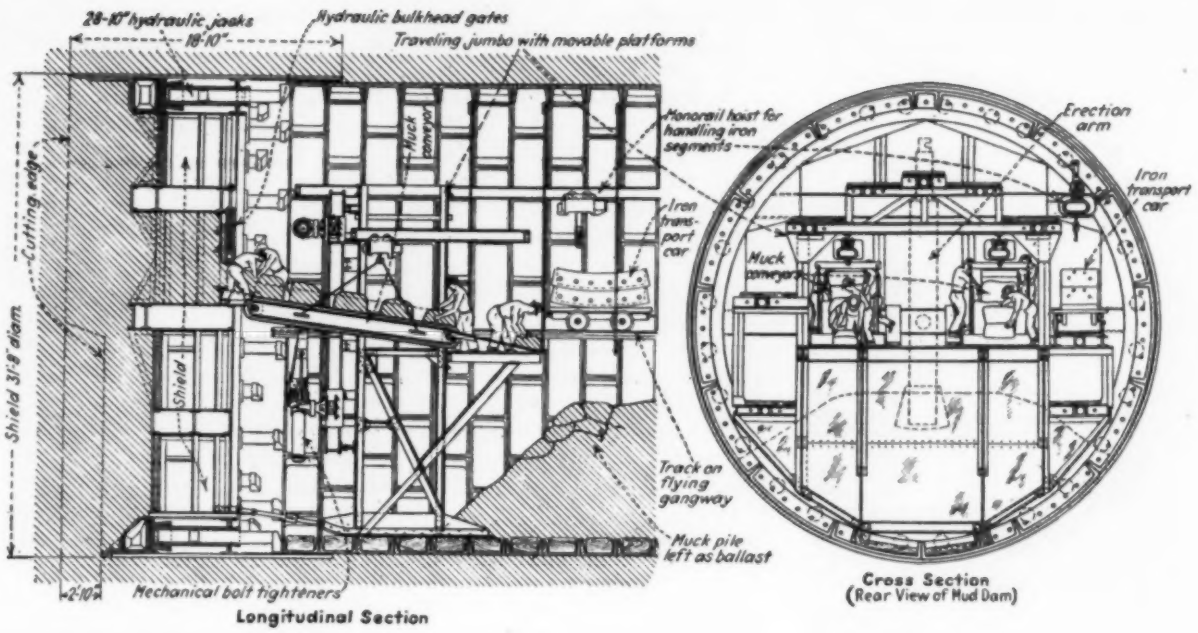
Tunnel Driving Progress

The table shown opposite gives representative performances on some of the Colorado River aqueduct tunnels.

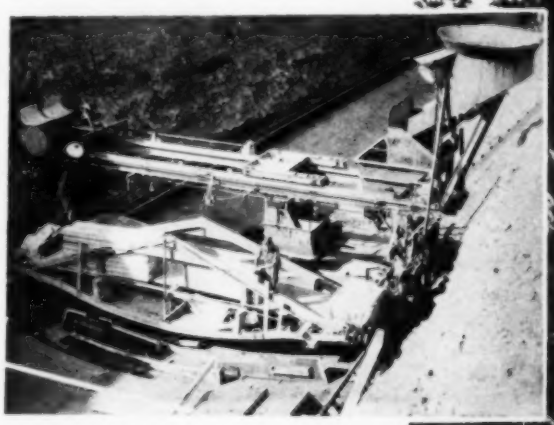
The first seven tunnels were largely excavated in the dry, through broken rock, and about 63 per cent of the length required timbering or steel supports. This work was all done under contract. The Valverde tunnel encountered considerable water and unstable formations, and the remaining four tunnels here listed also encountered some water, the San Jacinto providing the most difficult conditions. These last four tunnels were done by day labor. The overall average rate of tunnel driving on the dry headings has been about 7 ft. per 8-hr. shift, at a cost of $3.90 per cubic yard, and on the wet headings 3 ft. per 8-hr. shift.

Lining of Tunnels

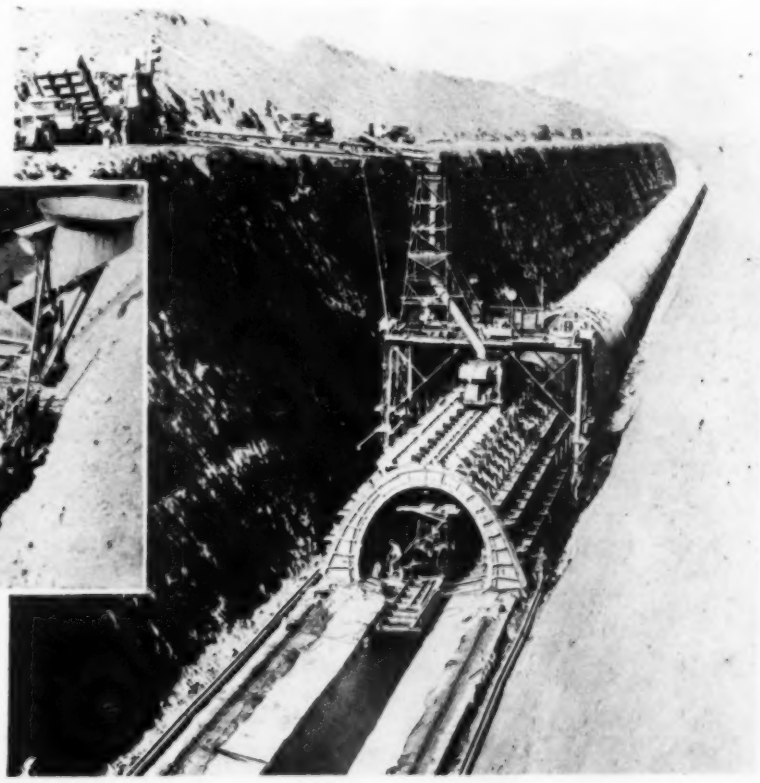
In broken rock it is necessary to erect temporary supports, either of timber, steel or steel ribs lagged with wood, and the concrete lining is later placed directly against the temporary supports. Steel forms have almost become standard for placing concrete lining because they are more economical for repeated use under uniform conditions, and they produce a smooth concrete surface. One of the various types consists of a long carriage on which collapsible forms are mounted; when collapsed, the forms may be transported through a section of form which is in service.



SHIELD DRIVING of Lincoln tunnel to carry vehicular traffic underneath Hudson River.



SPECIAL PAVER UNIT for placing invert for cut-and-cover conduit on Colorado River aqueduct.



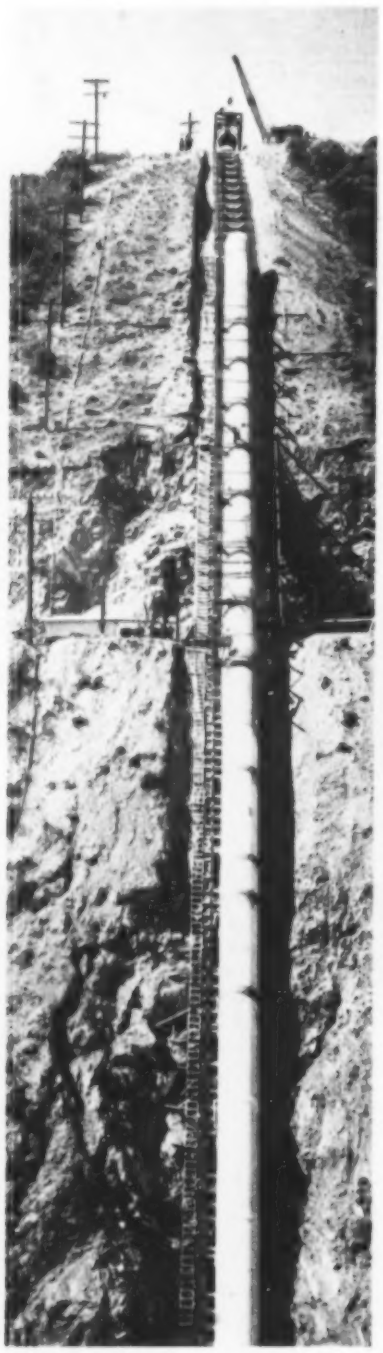
TRAVELING ARCH FORMS and concrete placing plant on Colorado River aqueduct.

INTERIOR of shield-driven Lincoln tunnel, showing cast-iron lining and muck left in place temporarily to serve as ballast.

On some of the 10-ft.-diameter distribution conduits of the Colorado River aqueduct a group of 14 circular steel panel forms, each 5 ft. long and hinged for collapse, were employed. These were mounted on a 160 ft. long by 5 ft. deep traveling truss. The collapsed form was supported on jacks and rollers and could be moved forward on the truss. This type, known as the Hackley type, is particularly suited to work on curves. (See accompanying diagram.) The reinforcing steel for this lining was brought in straight to the site of concrete placement and bent there. This procedure was found to be more economical than to handle the cumbersome curved pieces through a long tunnel.

The aqueduct tunnels have a minimum thickness of 9 in. of concrete at the crown and 6 in. on the side. On some operations, 100 ft. of forms were set up at one time and placing was more or less continuous. No special construction joints were provided, the front of the concrete merely sloping off in a distance of 60 to 90 ft. The steel forms weighed about 1,200 lb. per foot and were equipped with side doors through which con-

crete in the side walls could be delivered and inspections made. They were stripped 10 to 12 hr. after the last concrete was placed. The sequence of placing tunnel lining was generally as follows: First, small curbs on each side which provide a base for alignment and support for the form carriers; second, the arch;



ERECTION of plate steel penstock on Bouquet Canyon project. Note straddling carriage for delivering sections of pipe line.

finally, the invert, after clean-up and removal of all pipes, wires, and tracks.

The aggregate was batched dry in a central plant at the tunnel portal and hauled in batch cars for mixing at the point of use. Placement was by means of concrete pumps or pneumatic placers. The latter are simple and low in first cost, but the pump, a comparatively modern development, has proved satisfactory and can handle a drier concrete.

The pipe line which carries the concrete is located in the top of the arch form and the concrete slides down the sides. The placing machine and pipe move forward as the form is filled, but the discharge end is allowed to remain embedded a short distance in the concrete at the crown and is sometimes moved forward and backward to insure better packing and placement in the rock irregularities. The high air pressure used with pneumatic placers helps to fill the irregularities. Further to assure the filling of voids and possible air pockets at the crown, heavy pressure grouting was applied to the completed lining.

One plant placed as high as 2,280 ft. of arch in one week. A total of 12,220 ft. of invert were placed by one plant in one week, using a special paver unit.

PRECAST CONCRETE PIPE 12 ft. in diameter is placed in mountainous region.

FIELD WELDING of joints on Bouquet Canyon penstock.

Equipment for Placing Tunnel Lining

The Hackley concrete placer operates by air pressure and has the advantage of employing no rotating parts. It consists of an ejector chamber with a capacity of ½, ¾, 1, 1½, 2, or 3 cu.yd. This is filled with concrete and then air is applied through a specially arranged set of pipe which propels the concrete forward into a 6- or 8-in. transport line; from 40 to 60 sec. are required to empty the ejector. As a rule the placer is set in a gantry crane to one side so that the muck cars from the heading will readily pass. The best conveying distance for this equipment is 80 to 140 ft., and 2 in. is about the maximum size of stone for this equipment. The 1-yd. machine requires about 1,000 cu.ft. per minute of air. On the aqueduct the 2-yd. machine placed about 900 cu.yd. in 24 hr.

Another type of pneumatic placer which has proved efficient and fairly economical on air is known as the Press-Weld concrete placer, which operates on 60- to 80-lb. air pressure. The Ransome pneumatic placer has a motor driven spiral screw to propel the concrete forward into the pneumatic chamber where the air is applied to drive it through the transport lines.

Among recent improvements in this equipment is the use of special alloys and replaceable plates at the wearing points and the introduction of long-radii bends in the transport lines. As a rule, 10,000 cu.yd. of concrete can be handled before replacements are necessary.

The most recent development in concrete lining methods has been the application of the Pumpcrete machine for tunnel work, as illustrated. On the aqueduct, 8 machines were employed, using 7- or 8-in. delivery pipes. (This machine was described in the previous chapter, the main feature being a direct ram which propels the concrete forward.)

The Pumpcrete placing units, in combination with mixers, received dry batches of concrete from a central batching plant located at the portal. The material was hauled in special batch cars, a train usually consisting of 10 cars containing 30 batches. In addition to the direct pumping action air at about 100 lb. was supplied to the discharge end, which helped to ram the concrete into the arch. Typical progress with this equipment was 116 lin.ft. of 18-ft. tunnel arch per three 8-hr. shifts. This was equivalent to 3.8 cu.yd. per foot, or 440 cu.yd. per day. A total of 103 men, including superintendents, made up the organization for three shifts; this included the men working in the shop, at the pit, in the batching plant, and in the placement crews.

On one of the Minneapolis sewer tunnels a special arrangement of the Pumpcrete unit was employed. This consisted of a pump set up on the ground, with concrete delivered through well holes to the tunnel, located a short distance below the surface. The tunnel varied in size from 3x6 ft. to 10x10 ft., and the ability to adapt this arrangement of Pumpcrete to different sizes of tunnels was a particular advantage.

Shield Tunneling

Some of the most difficult problems in construction are encountered in driving a tunnel shield through subaqueous formations of earth or loose material. The operations are highly specialized and require a great deal of knowledge and experience. The present high state of efficiency in shield tunneling has been attained through expert organization, coordination of the individual steps, and ingenious plant layout. The most recent examples are the Lincoln tunnel under the Hudson River in New York, and a Detroit sewer tunnel.

On the Lincoln tunnel, which is 31 ft. outside diameter, the tunneling was done by the silt displacement method, under which 75 to 80 per cent of the silt was pushed aside and only enough of the core was

passed through the shield to serve as ballast against flotation of the tube. The shield was 31 ft. 8 in. in outside diameter by 18 ft. 10 in. long, and weighed about 310 tons. The advancing face of the shield was closed off completely except for two bulkhead gates, 2 ft. 4 in. square, through which silt was admitted as the shield was shoved forward by the action of twenty-eight 10-in. hydraulic jacks mounted on its periphery and pressing against the front edge of the cast-iron lining assembled immediately behind the shield. The shield had a cast-iron cutting edge and special working platforms whose elevation was hydraulically controlled. Several short sections of belt conveyor located just behind the bulkhead gates deposited the silt beyond the shield on to the completed section of cast iron lining.

A special mechanical erector arm handled the cast-iron liner segments, which are 30 in. wide and of which fourteen are required per ring. As the rate of progress was not controlled by the mucking but by the bolting of the cast-iron segments, a special type of hydraulic bolt tightener was developed to speed up this operation. Four units worked on a ring at one time. This tightener constitutes a major advance for this class of equipment. There are 2,360 cast-iron segments in the tunnel, weighing 51,800 tons and requiring 346,000 bolts, 1¾ by 8¼ in., for the assembling. A diagram of the shield is shown in one of the illustrations. A gang working on a heading consisted of 35 men and they worked in 16 to 18 lb. of air.

On the Lincoln tunnel, 5,060 ft. were driven in seven months, a record of 1,040 ft. being made in one month of 24 days. An average daily shift drove about 40 ft. in 24 hr. In comparison with this, the Holland tunnel record was 555 ft. in one month and 25 ft. in one day.

PENSTOCK FABRICATION PLANT erected at site of Norris Dam for assembling pre-bent plates, welding all joints, followed by stress relieving processes and X-ray inspection.

On the Detroit sewer tunnel, which was 22 ft. in diameter, 50 ft. were driven in a 20-hr. day. In this case practically all of the muck was taken through the shield through six 2x2-ft. openings in the bulkheads, the driving being through a soft blue clay under air pressure. The shield was 15 ft. long and equipped with twenty 10-in. jacks. Instead of a cast-iron lining, there was a primary lining of interlocking concrete blocks 18 in. thick and 30 in. wide, which were handled by a special rotating placing arm. The final lining was a 16-in. concrete inner lining constructed monolithically by standard tunnel lining methods at a rate of 50 ft. per day. The handling of the muck out of the tunnel was a major problem here. One shove delivered about 40 muck carloads of clay into the tunnel, and a special roll-over dumper was used at the unloading point to remove the sticky material and to expedite the handling of cars.

Concrete Pipe

The erection of special precast concrete pipe of large diameter has reached new forms of application on the Colorado River aqueduct, where 12-ft. diameter, 12-ft. long sections, each weighing 40 tons, have been installed. The precasting of pipe sections in special, well-equipped yards was handled by systematic methods. The reinforcing cages were made up in advance and set into steel inner and outer forms, after which the concrete was placed and vibrated for compaction.

The reinforcing, instead of being made up from individual hoops, was rolled on large diameter mandrels from continuous rods. The completed sections of pipe were painted with a coal tar to retain the moisture and prevent too rapid drying and curing, and were later transferred on special heavy-duty trailers. In the level sections of the pipe line a heavy derrick straddling the trench lifted the pipe from the trailers into place in the trench. On inclines the sections were hauled up on special railroad trucks and skidded to place on steel rails which were set to line and grade, after which a continuous concrete cradle was poured under the assembled line before final backfill was placed. The design of the pipe is rather standard, but the joints are of special importance to assure both continuity of the structural pipe line as well as water-tightness.

Penstocks

The Bouquet Canyon pipe line in California, which was placed over exceptionally rough terrain and on steep slopes, represents one of the recent developments in modern all-welded penstocks It is 90 in. in diameter and designed for a maximum head of 820 ft., or 400 lb. per square inch. The thickness of plates varies from ⅜ to 1 3/16 in. The sections weighed about 10 to 12 tons and were carried by a "straddle bug" carrier running on rails which straddled the penstock line. The individual sections of pipe were lowered with an electric hoist.

At Norris dam a special penstock fabricating plant was erected near the dam and the bent plates were received from the shop and assembled here by electric welding. The field plant included special X-ray and stress relieving equipment. The completed sections were delivered to the dam on a heavy-duty trailer and transferred into place by cableways.

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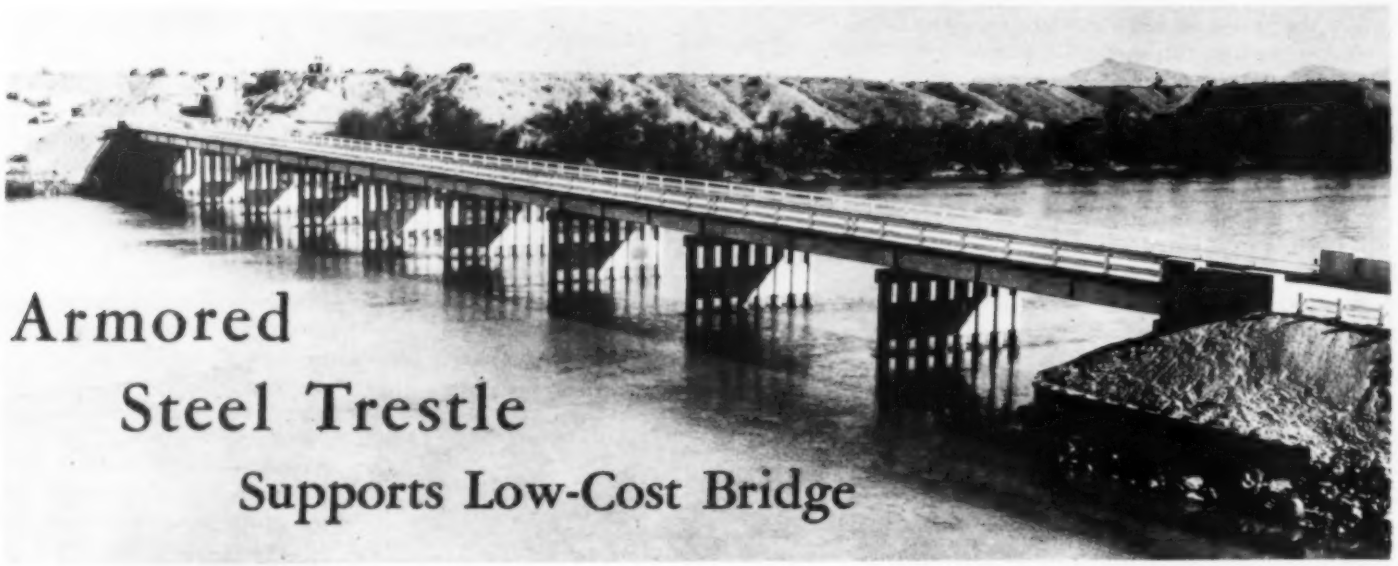
NEXT CHAPTER—Because the January issue of CONSTRUCTION *Methods and Equipment* will be the Annual Road Builders' Number, the next chapter of the series on "Heavy Construction," by Ackerman and Locher, dealing with electric power and equipment, will appear in February, 1938.

Collapsible Forms Re-Used Ten Times

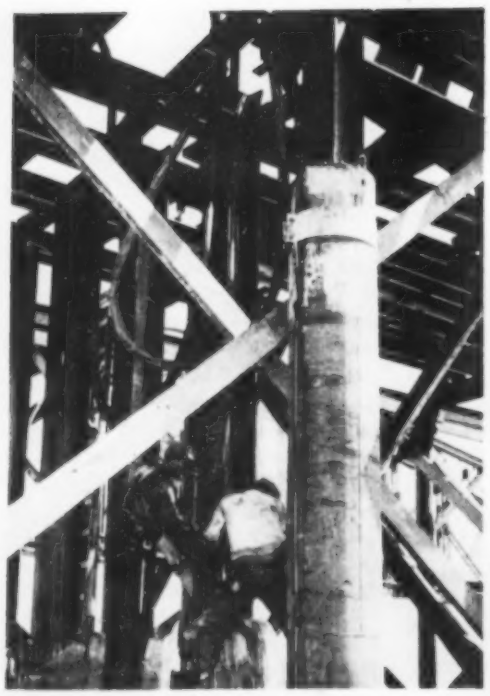
IN THE CONSTRUCTION of dam No. 13 on the Mississippi River at Fulton, Ill., it was necessary to build some circular tunnels in the tainter gate piers. In view of the fact that the operation had to be repeated ten times, the mill foreman, F. C. Rockwood, devised the collapsible forms shown in the accompanying three pictures, received from A. Fletcher Marsh, vice-president, Marsh & Truman Lumber Co., of Chicago.

Photo 1 shows inside view of form unit. Photo 2 shows section made to fit against first section, with top 6 in. lower, as illustrated in Photo 3. In Photo 3 one brace has bolt released ready for removal of wedges that allow form to contract for easy removal.

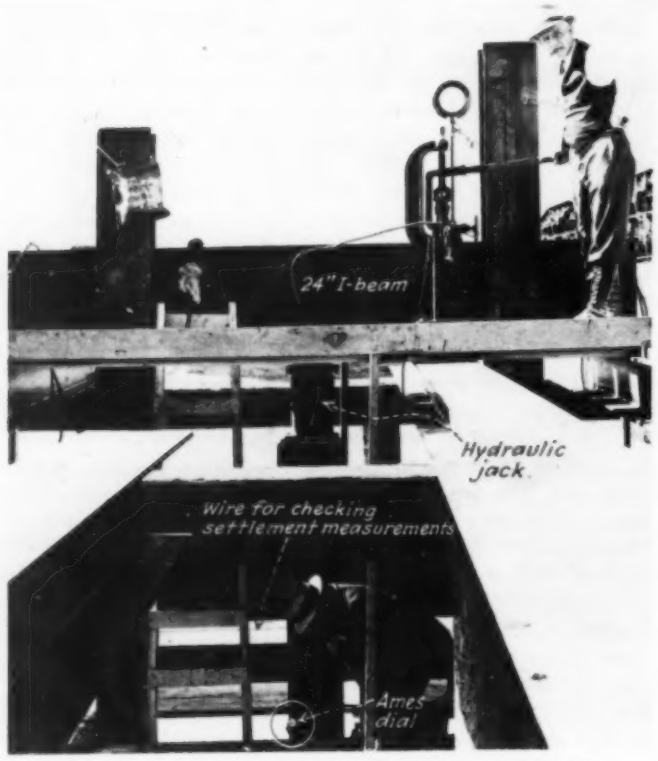
Armored Steel Trestle Supports Low-Cost Bridge



NEW TRESTLE TYPE highway bridge across Colorado River at Parker is of simple design, durable and inexpensive. It cost less than previous bridges because provision for heavy floods is now unnecessary.



CYLINDRICAL FORMS for concrete casing around steel piles are cleared of silt by jetting prior to pouring tremie concrete.



TEST LOAD is applied to steel pile by hydraulic jack under 24-in. I-beam, as G. F. Wickes *(top)* and Harry S. Hart *(below)* observe settlement with aid of dial readings checked by wire guide.

80-FT. STEEL PILE *(left)* is swung into place and jetted down to point under hammer leads.

THE CONTROL OF FLOODS on the Colorado River which is accomplished by Boulder dam eliminates the flood scour menace to bridge piers that has previously threatened—and destroyed—bridges in periods of high water. Since the destructive floods cannot recur, the recent design of a new highway bridge across the Colorado River below Parker dam was modified accordingly. Instead of the long spans and deep piers which have been the requirements heretofore, simple trestle bents were used. The shortest spans heretofore economical anywhere on the lower Colorado River were 188 ft. and a railroad bridge less than 200 ft. from the new Parker highway bridge has five 288-ft. steel truss spans. The maximum control flood in the river will be only 75,000 sec.-ft. and hence the new bridge has a river channel only 600 ft. wide and the spans between each of the ten trestle bents are only 63 ft.

In addition to the economical features of the Parker bridge the method of construction involved items of interest: the river bed here is sand and gravel for great depths and it was decided to use for piles in the trestle bents, 12-in., 74-lb. H-columns, each 80 ft. long. Eight piles were used per bent and from a level 3 ft. below river bed specifications required that they be encased in concrete to protect the steel from rust.

From a falsework deck 25 ft. above streambed the contractor drove the piles with a 10-B2 McKiernan-Terry hammer, aided by a jet from a 6-in. Byron-Jackson centrifugal pump operated by a 200-hp. Hall-Scott motor. The piles were driven by first lowering them to position with a crane and jetting them about 25 ft. into the river bed after which it was possible to get the driving hammer over the top of the pile. The hammer was mounted on a skid driver with 40-ft. leads and operated from the trestle. After the hammer was brought into use, the jets were continued and aided in getting the piles down to grade. When pile driving in a bent was completed, a 24-in. cylinder 22 ft. long was slipped over the top of each pile and jetted down to grade. This cylinder was hinged longitudinally and had criss-cross rods welded at top and bottom for centering the cylinder around the pile.

After being set at grade, the cylinder was washed clear of sand with the jet and then was filled with tremie concrete. When the concrete had hardened, the hinge pin was pulled and the halves of the cylinder were removed and laid aside for reuse.

The entire cost of the bridge, including an 800-ft. approach fill and the necessary bulkhead wall and riprap was about $140,000, a record "low" for highway bridges on the lower Colorado River.

The contractor was the Wickes Engineering & Construction Co. of Des Moines, Iowa. Design and construction was under the direction of the U. S. Bureau of Public Roads, C. H. Sweetser, district engineer; George D. Whittle, bridge engineer, and Harry P. Hart, resident engineer.

Congress Needs YOUR Guidance....NOW

An Opportunity for the Million Readers of McGraw-Hill Publications to Help Business Recovery

TODAY, everybody sees that private industry *alone* can lead the march back to prosperous times. Business leaders, labor leaders, legislative leaders, and now the National Administration, all agree that the leadership must pass from government to private enterprise. As spokesman for the Administration, Secretary Morgenthau has said:

"The basic need today is to foster the full application of the driving force of private capital. We want to see capital go into the productive channels of private industry. We want to see private business expand."

So do we all. Nothing can take the place of expanding business. The business man needs it to meet his expenses and earn a profit. The investor needs it to put his capital to productive use. More than anyone else, the workman needs it for a steady job at regular wages. And the government needs it to get the revenues required to carry on. Everyone needs better business; there is no other way forward. But if business is to resume its leadership, government must revise its policies to make the shift possible.

Everyone who knows anything about federal taxes knows that the present system is not sound; it has been made even less so by some of the experiments of the last few years. However good those experiments may be in theory, their practical result is to frighten business men and investors from taking the risks that are necessary for business revival. As Secretary Morgenthau puts it:

"We realize that our tax laws are too complicated; we want to make them less so. We realize that there are inequalities; we want to eliminate as many of them as we can."

With this encouragement from the Administration, Congress now must get at the job. Many see the need, but it is Congress that must do something about it. What it does will depend on how it interprets the views of the people. *The time has come for the people to tell their Congress what they want.*

At no time since 1929 have business people—employers and employees—had so promising an opportunity to impress their views and their needs on the Washington government. The iron is hot; now is the time to strike!

Specifically, these three needs are urgent:

First—*Repeal the undistributed earnings tax.* As a producer of revenue it is discredited. Its chief effect has been to obstruct recovery and curtail employment by holding back the normal plant improvements by industry. Such improvements make for higher efficiency, *the only means by which consumers can get more for their money, without loss of income as producers.* Altogether, the undistributed earnings tax

obstructs development, destroys employment, and encourages unsound financial practices. It should be repealed.

Second—*Repeal or amend the capital gains tax.* As it now stands, the investor who sells securities when prices are rising must give the government a large slice of his profit; but when he sells on a falling market he must eat his own losses. That is a one-sided and unfair proposition. It is heads-the-government-wins, tails-you-lose. It discourages the sound investment practice required by stable business. It should be repealed or amended to allow adequate deductions for losses.

Third—*Reduce the excessive personal surtaxes.* These high taxes were designed to reach for 75 per cent of the rich man's income. Whatever may be said for that objective in theory, it doesn't work in practice. It *appears* to "soak the rich" but in fact it is a blow in the air. For the rich can escape by hoarding their wealth in tax-exempt securities—municipal and government bonds rather than industrial securities. It is the latter that create productive enterprise, with orders for business and jobs for workers. So the effort to exact excessive taxes from the rich drives funds out of industrial employment and into government bonds; at the same time it dries up the source of the desired taxes. Excessive surtaxes are a good example of losing all by over-reaching; they should be amended to encourage enterprise and increase revenues.

The America of today is possessed of the same driving force that created it. All it asks is a chance to resume its progress. In the early days of our national development, government paid huge bounties to encourage private construction of the railroads. Today industry asks no bounties; it asks only a chance to invest in national progress the surplus wealth that it has itself created. It is willing to meet the increased obligations of social progress and to pay its share of the governmental costs, but it asks relief from the shackles of restrictive and confiscatory taxation. It is ready to resume its interrupted march toward restored prosperity if only Congress will loosen the bonds that now confine it. Only Congress can effect that release. It can do so only by revising restrictive taxation. And only the American people can prevail upon Congress to meet that appeal *and to meet it NOW.*

Congress needs *YOUR* guidance. Will you give it *NOW?*

James H. McGraw, Jr.

President, McGraw-Hill Publishing Co., Inc.

If private capital and business initiative are to take a leading role in recovery—then it is the obligation of the business and technical press to study ways and means by which this is possible; to keep business and industry currently informed; to mobilize opinion and to make that opinion felt and understood by the government, which has the power to obstruct or to encourage business and industrial progress. McGraw-Hill Publications recognize that obligation. We are seeking in this editorial effort to provide an avenue through which our one million readers—America's business and industrial leaders—may indicate to the Congress the need to change the tax system so that industry can move forward more surely and rapidly.

USE THESE CARDS... *NOW!*

To encourage Congress to revise taxes NOW

To secure extra copies of this editorial

To get a comprehensive analysis of taxes

To encourage Congress to act now along the lines of this editorial, send in one of the cards below—now. Studies have shown that an average of 4 persons read each copy of this publication—so four cards are here provided—one for each reader.

Extra copies of this editorial are available for you—at cost—should you desire to put this into the hands of your associates, employees or friends. You may order these on the card below, too.

Business Week is publishing in one of its December issues a comprehensive analysis of the tax situation. You may secure a free copy of this analysis by checking and mailing the card below.

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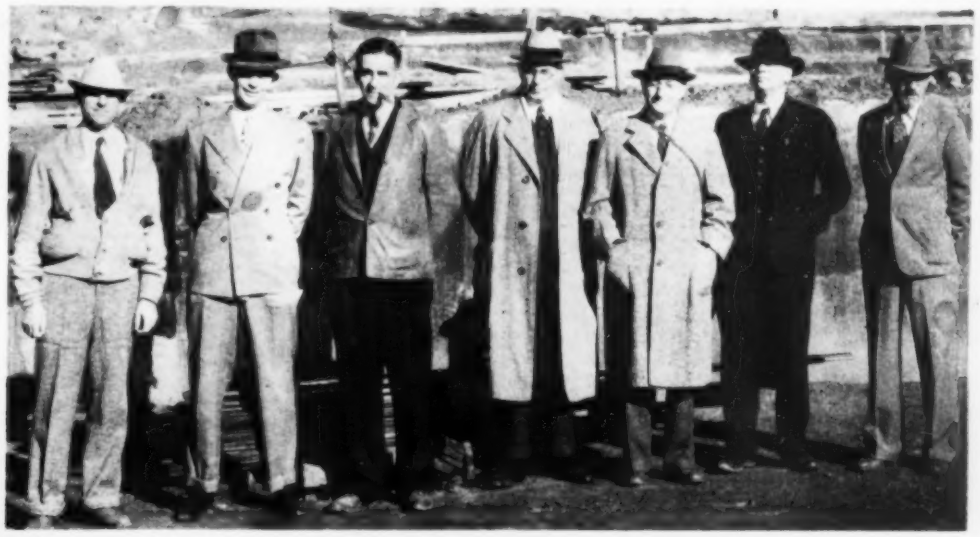
Present and Accounted For –

A Page of PERSONALITIES

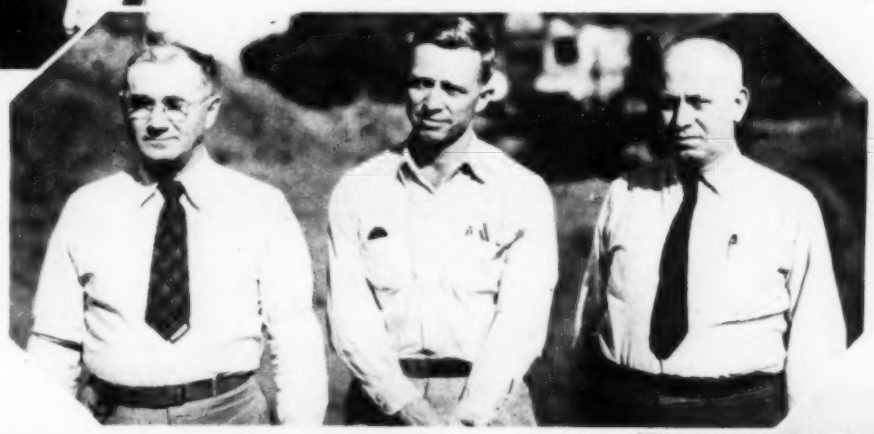


CONCHAS DAM

being built on South Canadian River in New Mexico by Bent Bros., Inc., and Griffith Co., of Los Angeles, for U. S. Engineer Department, is inspected by new chief of Engineers, Major-General Julian L. Schley and group of army engineering personnel including *(left to right):* JOHN B. ALEXANDER, inspection chief; CAPTAIN L. H. FOOTE, engineering chief; CAPTAIN HANS KRAMER, district engineer in charge of constructing Conchas dam; COLONEL E. REYBOLD, division engineer, Southwestern division; MAJOR GENERAL JULIAN L. SCHLEY, Chief of Engineers; BRIGADIER GENERAL MAX C. TYLER, assistant Chief of Engineers, HARRISON V. PITTMAN, construction chief.

HOUSING ADMINISTRATOR

appointed to head U. S. Housing Authority created by Wagner Act, is NATHAN STRAUS *(right)* of New York City, newspaper publisher and former state senator, who is being welcomed to his new post by Harold L. Ickes, Secretary of the Interior. New Housing Authority takes over functions of PWA's Housing Division and will direct low-cost housing program involving $526,000,000.



U.S. RECLAMATION ENGINEERS

(left) who will be in immediate charge of field operations on Delta Division of Central Valley project, in California, include *(left to right):* O. G. BODEN, division engineer; RICHARD A. YOUNG, field engineer; and GARFIELD STUBBLEFIELD, office engineer.

OKLAHOMA HOUSING PROJECT,

named Will Rogers Courts in honor of Oklahoma's famous son, is built by Leo Sanders, contractor, of Oklahoma City, under direction of PWA housing division, with these men in charge: *(left to right)* J. W. JOHNSON, project manager for PWA, and Virgil D. Alden, project engineer; C. B. TAYLOR, coordinator for contractor, Mr. SANDERS, and H. A. FRANKENSTEIN, general superintendent.

CENTRAL VALLEY PROJECT

of U. S. Bureau of Reclamation, to cost $170,000,000, gets under way in California under general direction of JOHN C. PAGE, (left) commissioner, and WALKER R. YOUNG, formerly in charge at Boulder dam, construction engineer on new project.

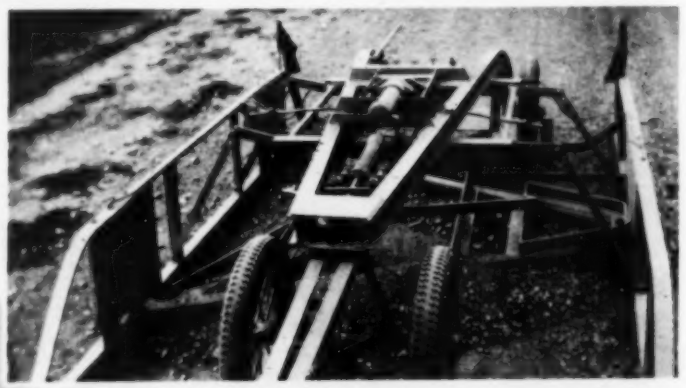
CONSTRUCTION EQUIPMENT NEWS

Review of Construction Machinery and Materials for DECEMBER 1937

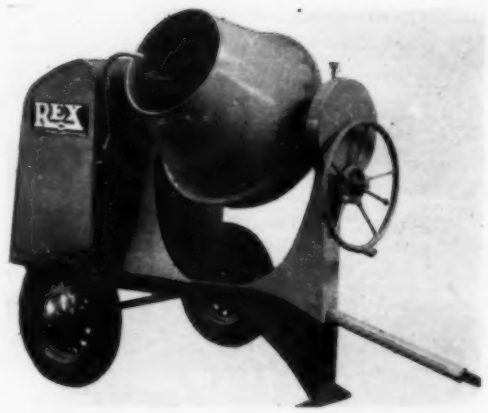
STRIPPING SHOVEL. (below) dipper capacity to 33 cu.yd. offers high speed cycle, ample power for heavy digging, economy of operation and dependability through following mechanical improvements: (1) New type boom, light in weight, increases speed of output; (2) large diameter steel handle welded to back of dipper takes only thrust loads, other stresses being carried directly by twin hoist ropes; (3) arc-welded, alloy steel dipper has alloy steel lip and protected heel; (4) mercury switch with leveling mechanism, included in propelling controls, operates hydraulic system which controls leveling and equalizing, eliminating much lost time and power waste; (5) individually powered crawlers with self-contained, hydraulically steered motors enable machine to move up during swinging cycle to steer around corners and to cut in or out from bank or slides; (6) counterbalanced hoist puts ballast to useful work; (7) Ward-Leonard variable voltage control and regenerative braking. Convertible to dragline use in field with booms to 250 ft. available. — **Bucyrus-Erie Co., South Milwaukee, Wis.**

SIDE-BY-SIDE TRAILER COMPRESSOR (below) 105-cu.ft. capacity, is 62 in. high, 65 in. wide and 114 in. long. Especially adapted for use where high degree of portability is essential; can be towed behind car with ease. Pneumatic tires, standard equipment. Available in either single or two-stage design. — **Davey Compressor Co., Kent, Ohio.**

PROTECTIVE CLOTHING for welders engaged in acetylene and arc work is supplied in fire-proof duck, asbestos and chrome leather. Outfits comprise goggles, sleeves, aprons, leggings, spats, gloves, helmets, handshields, coats and pants. Goggles, helmets and hand shields equipped with glasses of various shades, each suitable for special type of work. Goggles in five different shades for use in jobs ranging from light brazing to heavy welding and three different shades of glasses for helmets and hand shields for light and heavy metallic electrode and carbon arc work respectively. Chrome leather garments considered most serviceable because they remain soft under heat. Designed to give worker maximum ease. Arc-welding garments protect body from effects of ultra-violet light as well as from heat and sparks. — **Davis Emergency Equipment Co., Inc., 55 Van Dam St., New York City.**



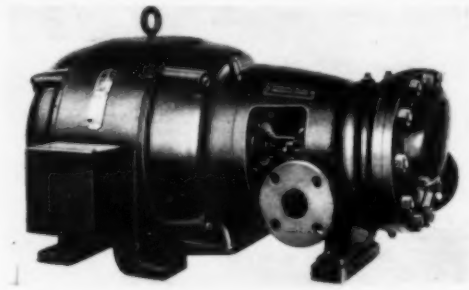
ROAD MAINTAINER (left and above), one-man machine features automatic control of blades by draw-bar pull without changing contour or crown of road for which machine has been set. Said to save upkeep on truck or tractor by regulating quantity of material carried in blades and preventing overloading. Designed for any type of bladeable road, such as earth, gravel, crushed stone, shell, sand and caliche and for laying black top and oil mat. Operated by hydraulic pressure, essential transportation and operating motions being controlled by series of valves operated by single pump. Standard angle and I-beam electrically welded construction. Built in two sizes: standard type 7 ft. 6 in. wide, weighing 2,100 lb. and 10 ft. 6-in. machine weighing 3,500 lb. — **Allen Road Machinery Corp., First National Bank Bldg., Shreveport, La.**



STREAMLINED HALF-BAG MIXER combining lightness and strength is said to produce 40 batches per hour on a 1-min. mix. May be hitched to truck and hauled at top speed due to automative type springs and perfect balance. — **Chain Belt Co., Milwaukee.**

TO QUIET RATTLING MANHOLE COVERS — Cushions, under name of Tapax, serve as gaskets for loose or rattling manhole covers. Cushion, in form of wire-reinforced asbestos tape impregnated with weatherproof, sticky adhesive, is installed along manhole flange between manhole cover and frame insuring full bearing surface and preventing noise. In form of flat ribbon, ¾ in. wide and ¼ in. thick, Tapax is shipped conveniently wound on reels. A reel carrying 200 lin.ft. of the cushioning tape is sufficient for 32 manhole covers 2 ft. in diameter. — **Trohn Supplies, Inc., Mamaroneck, N. Y.**

TWO-STAGE CENTRIFUGAL PUMP, with pump and motor built together for operation against heads up to 500 ft., offers less expensive alternative for multi-stage and split-case units. Qualified for portable, semi-portable and stationary service. Adapted to all classes of general pumping service with liquids low in viscosity and free from excessive foreign matter.

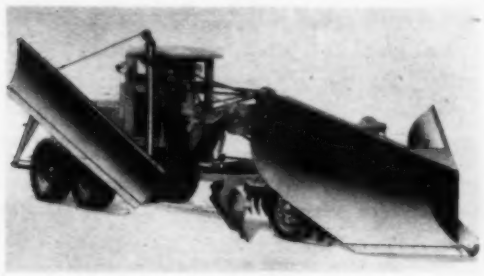


Compact design advantageous where space is limited. Can be mounted in horizontal, vertical or angular position without foundation, if necessary. Pump mounted directly on shaft of splash-proof motor. Two ball bearings take all radial and unbalanced thrust loads. Impellers for two stages placed back to back, compensating thrust. First stage unit placed next to motor, second stage on outside, simplifying cross-over passage and placing stuffing box under suction instead of pressure. Mounting leg under pump gives unit added stability. — **Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill.**

LIGHT-WEIGHT BELT CONVEYOR built to handle multiplicity of jobs for small contractor. Moves sand gravel and stone at rate of 30 to 70 tons per hour Length 20 ft. May be used either with gasoline engine or electric motor or purchased without power unit. Rubber covered, four-ply belt is 18 in. wide with electrically welded angles. All-steel head and foot pulleys are 9x20 in. and 6x20 in. respectively.

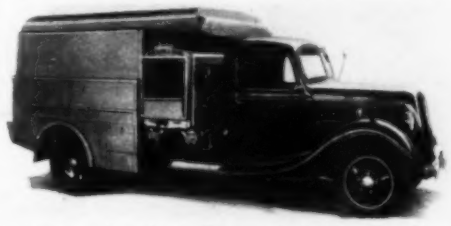
Drive accomplished through chain and sprockets Diameter and face of road wheels, 30x4 in. Rigid-axle-type truck. Loading height, 12 in.; discharge height, 8 ft. 6 in. Overall width, 5½ ft. Weight 1,750 lb., with power.—**Atlas Conveyor Co., Clintonville, Wisconsin.**

V-TYPE SNOW PLOW and snow wing for use on Adams motor graders of 39, 57, 59 and 62 hp. Plow, 3 ft. 6 in. high in front and 6 ft. high in rear, is streamline model designed to give maximum throw of light snow at high speed and to move heavy



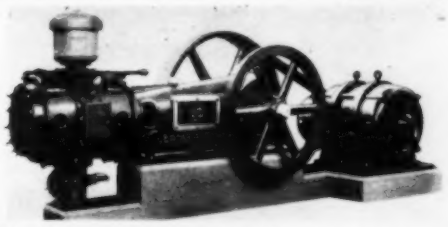
snow with minimum of power. Curvature lifts snow as much as 5 ft. before throwing it out. Wing for sloping snow banks is 12 ft. long, flares from 31 to 36½ in. wide and is independently adjustable for height at both ends. May be set horizontally to move light snows outward as much as 10 ft. or angled to deliver snow on top of 10-ft. bank. Both machines power controlled utilizing regular power outlets at standard power-control box furnished with each grader. — **J. D. Adams Co., Indianapolis, Ind.**

SELF-CONTAINED UTILITY COMPRESSOR UNIT for mounting on motor truck is 6 ft. 7 in. by 2 ft. 3½ in. and will operate one 45-lb. jackhammer and



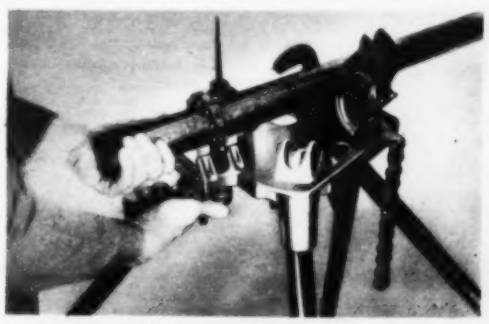
one paving breaker. Powered independently of truck motor and transmission. Compactness of unit allows truck to be used for transportation of tools, men and necessary equipment required for maintenance work. Weight, 2,100 lb. Equipped with lifting bale for easy transfer to ground or from one truck to another. Usually placed crosswise of truck body to conserve space. — **Ingersoll-Rand Co., Phillipsburg, N. J.**

SINGLE-STAGE HORIZONTAL AIR COMPRESSOR for heavy-duty full load service and continuous operation at low power costs. Important feature is electro-pneumatic control by which air supply is automatically adjusted to fit load requirements, re-



sulting in part-load economy. Compressors equipped with Timken tapered adjustable roller main bearings. Also features totally inclosed dustproof construction (without sacrifice of accessibility), accurate balance, and freedom from vibration. — **Gardner-Denver Co., Quincy, Ill.**

VISE-STAND combining stand, chain pipe vise and pipe bender is made of high-grade malleable iron. Legs are 1-in. pipe with upset feet punched for fastening to floor. Legs may be folded for carrying and



are held together by simple tie chain. Vise jaw of hardened and tempered tool steel. Finished in orange enamel with black legs. Weighs 235 lb. and takes pipe ⅛ to 2 in. Pipe-bender handles pipe up to ¾ in.—**J. H. Williams Co., 75 Spring St., New York City.**

NEWS FROM MANUFACTURERS *About Their Products*

The publications reviewed below, will keep you posted on latest developments in construction equipment and materials available for your use.

USES FOR SHEET METAL—**Republic Steel Corp.**, Cleveland, Ohio. (20 pp. illustrated). Booklet entitled "The Path to Sheet Metal Permanence," contains more than sixty photographs depicting many uses for sheet metal in wide variety of applications. Information on rust resistance and forming and welding properties, as well as data on physical properties and constants, forms, finishes, sizes and gages.

• • •

TAPES AND RULES—**Lufkin Rule Co.**, Saginaw, Mich. (45 pp. illustrated). Pocket-size booklet known as "Engineer's Tape and Rule Booklet No. 2", describes and illustrates tapes and rules used by engineers, surveyors, roadbuilders and the oil industry. Items include several types of engineer's steel tapes on reels and in lock handle frames, "Hi-way" drag tapes, chain tapes, oil gaging steel tapes, linen tapes, manually operated tape rules, tape repair kit and other tape accessories; aluminum folding rules, spring joint rules, folding extension rules, spring tempered steel rules; calipers and micrometer calipers. One page devoted to tension and temperature standards, standardization, etc. Convenient for carrying to job or field.

• • •

EXCAVATING EQUIPMENT—**Koehring Co.**, 3026 W. Concordia Ave., Milwaukee, Wis. (32 pp. illustrated). For general distribution to contracting and industrial markets. Depicts Koehring excavators on the job and disassembled for detail construction views of crawler assembly, carbody, center pin, turntable, swing and traction shaft, brakes, drums, clutches, power unit, boom, upper machinery, chain crowd and dipper.

• • •

PIPE MANUAL—**American Cast Iron Pipe Co.**, Birmingham, Ala. (Tenth edition, 205 pp. illustrated). Attractively bound in semi-flexible leather and in manner which permits pages to lie flat when book is opened. Covers several products for first time. Various chapters profusely illustrated with installation and step-by-step action photographs. Section titles give an idea of subjects treated: (1) History; (2) Mono-Cast Centrifugal Pipe; (3) Bell-and-Spigot Pipe and Fittings for Water Service; (4) Bell-and-Spigot Pipe for Gas Service; (5) Flanged Pipe and Fittings; (6) 2-in. Cast-Iron Pipe; (7) Special Joints for Cast-Iron Pipe; (8) Cement-Lined Pipe and Fittings; (9) Cast-Iron Well Tubing and Casing; (10) Monoloy Threaded Cast-Iron Pipe; (11) Acipco Cast-Iron Columns; (12) Miscellaneous Tables and General Information for Water and Gas Works Superintendents, Engineers and Contractors. Copies free upon request to any office of Company.

• • •

COLD WEATHER CONCRETING—**Lone Star Cement Corp.**, 342 Madison Ave., New York City (16 pp. illustrated). "How to Find Most Economical Construction Method for Given Job" is theme of this booklet which presents to contractor examples and data on use of Incor high-early-strength concrete in making winter jobs productive. "Minimizing Winter Costs" is subject of one chapter which is amplified by two tables, Table 1 giving mix proportions and quantities of materials per cubic yard of concrete for a range of mixes, and Table 2 indicating effect upon strength when concrete is exposed to lower temperatures after heat protection for various periods. Another topic, "Winter Job Practice," summarizes successful methods of cold-weather concreting.

UNPAVED ROAD SYSTEMS—**Solvay Sales Corp.**, 40 Rector St., New York City. (33 pp. illustrated). Non-technical booklet dealing with maintenance, construction and development of low-cost roads. In easy-to-understand language it treats of following topics: Reducing loss of surfacing materials; cutting blading and dragging costs; principles of road surface stabilization; partial, or stage-, stabilization; stabilized base pavements; practical hints on maintenance; state, county and township highways; city and village streets and alleys; park and forest roads; maintenance of road shoulders.

• • •

ELEVATING GRADERS—**Caterpillar Tractor Co.**, Peoria, Ill. (37 pp. illustrated). Elevating graders and the work they do are topics of this new booklet which features specifically Nos. 48 and 42 power-controlled models presenting action and shop photographs, precise captions, charts and specifications.

• • •

SNOW REMOVAL—**Barber-Greene Co.**, Aurora, Ill. (24 pp. illustrated). "Low-Cost Snow Removal" is title of booklet which shows uses of Barber-Greene Model 38-D snow loader which delivers 10 cu.yd. a minute and the Junior snow loader (Model 558) delivering 7 cu.yd. a minute and designed to bring economies of mechanical snow removal to cities and companies previously unable to make initial investment for larger machine. Table showing seasonal snowfall of last 25 winters.

• • •

CRUSHERS—**Universal Crusher Co.**, 625 C Avenue, N. W., Cedar Rapids, Iowa. Has just issued three bulletins, No. 100 covering their line of bronze-bearing jaw crushers; No. 200 illustrating and describing roller-bearing jaw crushers; No. 300 pertaining to Universal roll crushers. Folder No. 19 also is available to those interested in Universal 30-Q semi-portable stone crushing plants. Each piece of literature gives complete construction details, dimensions, specifications and other data.

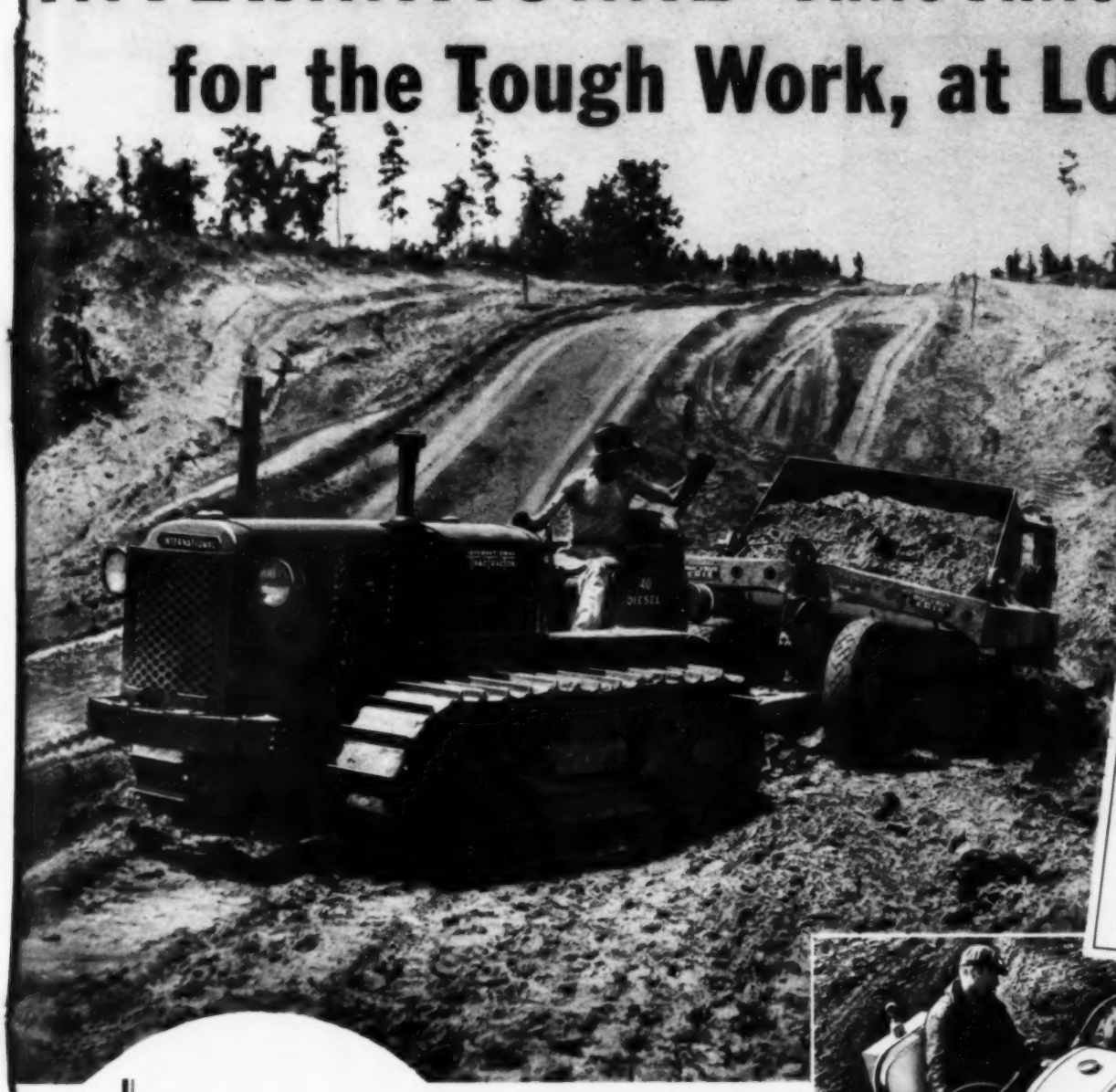
• • •

PIPE THAWING MANUAL—**Hobart Brothers**, Hobart Square, Troy, Ohio. (22 pp. mimeographed, loose-leaf in fabrakoid binder). Comprehensive treatise on thawing of pipes with portable arc-welding machine. Lists advantages of method such as cost, labor saving, convenience, safety. Sets down hints for successful pipe thawing gleaned from experiences of users of Hobart gasoline-powered low-voltage generators and also a series of hints on the same subject issued by Water Dept. of Chicago, Ill. Fourteen field reports with diagrams on job results by users of Hobart "Simplified" arc welders.

SLOPE-TRIMMING MACHINE for finishing canal sections, prior to lining with concrete, illustrated and described in this journal for October, 1937, p. 39, was developed, used and patented by the Jahn & Bressi Construction Co., of Los Angeles, Calif., for

use on their contracts with the Metropolitan Water District of Southern California. This slope-trimming machine was supplemented by a concrete finishing machine developed and patented by Clyde W. Wood, of Stockton, Calif., and used on his Colorado River aqueduct contracts. The two machines were sold to J. A. Terteling & Sons and cut down for use on the smaller canal section of the U. S. Bureau of Reclamation's Roza project in Washington.

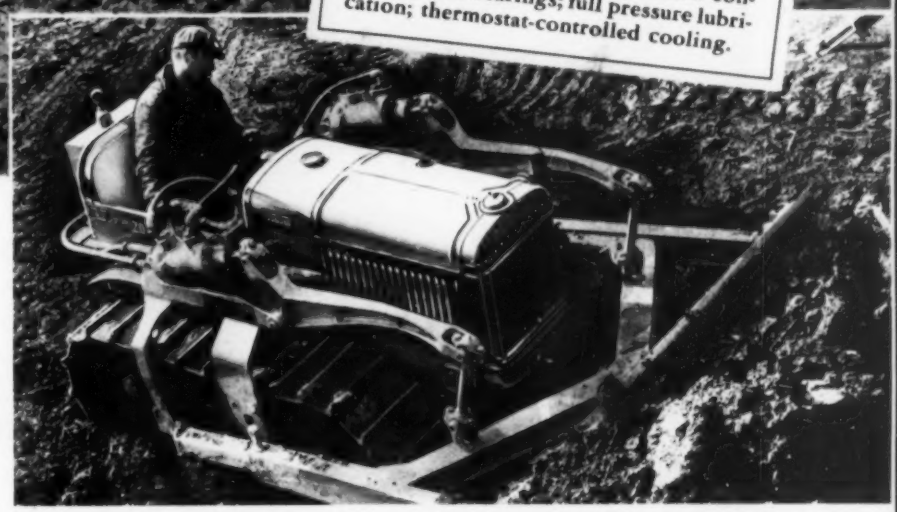
INTERNATIONAL TRACTRACTORS . . . .
for the Tough Work, at LOW COST



BRIEF FACTS concerning International Harvester DIESEL ENGINES:

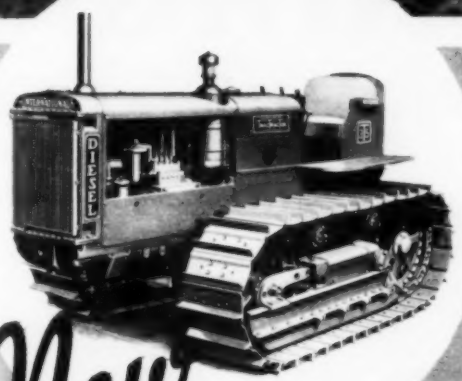
International TracTracTor Diesel Engines start on gasoline and shift automatically to Diesel operation after warming up for one minute or less. They are full Diesels in every respect—compression ratio is 17 to 1.

Regular features include: Chrome-nickel, molybdenum alloy cylinder head; special alloy, heat-treated, individually replaceable cylinders; aluminum alloy pistons with silchrome steel top inserts; full-floating piston pins; Diesel fuel injection pump with stainless, rust-resisting parts; easily replaceable injection nozzles; variable-speed governor; Tocco-hardened crankshaft; easily replaceable precision-type main and connecting-rod bearings; full pressure lubrication; thermostat-controlled cooling.



Above: *Powerful International TD-40 Diesel TracTracTor operating a 4-wheel scraper. A popular combination on dirt-moving jobs everywhere.*

At right: *The International T-20 TracTracTor equipped with bull-grader. Shown on excavation work, a job for which this compact outfit is ideally suited.*



New

MODEL TD-35 DIESEL TRACTRACTOR

The popular features of International Diesel design are now available in the new International Model TD-35 — a smaller Diesel TracTracTor at a lower price. In addition to its Diesel engine, the TD-35 also features 5-speed transmission; ball bearings at 43 points; heat-treated replaceable cylinders; Tocco-hardened crankshaft; special dust seals; oil strainer; air cleaner; fuel filters; and unit construction throughout. Complete information will be supplied on request.

TRACTRACTOR is the choice when it comes to those hard, heavy jobs that call for a lot of *action* and a lot of *economy.* And remember this, International TracTracTor economy is more than thrift in fuel consumption. These powerful tractors are built for maximum performance on the job, and for minimum expense when service is needed. Men who have had experience with other crawlers are the first to praise the TracTracTor for its genuine economy in every phase of operation.

The swing is to TracTracTor these days, with the tractor factories of International Harvester—*world's largest tractor builder*—hard-pushed to keep pace with demand. Investigate TracTracTor design, quality, performance, and economy and you will find the logical answer to your power problem. The nearest International Power dealer or Company-owned branch will gladly show you the International TracTracTor—five models—and make a convincing demonstration if you just say the word. The International line also includes a wide variety of wheel-type industrial tractors, and power units in sizes up to 110 maximum horsepower.

INTERNATIONAL HARVESTER COMPANY
(INCORPORATED)
180 NORTH MICHIGAN AVE. CHICAGO, ILLINOIS

INTERNATIONAL Industrial Power

THEY RIPPED *Two Months* OFF THE CALENDAR!

Read how Shell helped Coleman Brothers of Boston finish an important job in record time

COLEMAN BROTHERS CORP. of Boston had been awarded part of the work on the Cape Cod Canal. 1,600,000 yards of dirt were to be excavated . . . 42,000 tons of riprap laid. And the job had to be done in 425 days!

Sound judgment dictated the next move. Shell engineers were called in to supervise lubricating of the Coleman equipment—trucks, pumps, gasoline and Diesel trucks and tractors—all completely serviced by Shell men. One day each week was devoted to complete inspection of all lubricated parts. And day after day—24 hours a day—this equipment performed at top-notch efficiency.

The result: Coleman Brothers completed the job in 365 days—two months ahead of schedule!

This company's experience with Shell products is no new story. Time after time—Shell products and Shell engineering skill have helped bring construction jobs through ahead of schedule. Whatever the problem you face—Shell men apply the ingenuity and resourcefulness born of long experience in solving the tough problems of industrial lubrication. This "plus" in lubrication that has helped so many others can aid you. Simply call or write your nearest Shell office.

SHELL

SHELL CONSTRUCTION LUBRICANTS

Connect Up with PROFITS

Cordeau-Bickford, the insensitive detonating fuse, acts as the detonator in the hole and the hookup for *all* holes. It assures maximum power from every cartridge and more effective results from every shot. Larger blasts are made feasible, better fragmentation is secured, and much less time is lost in moving equipment back and forth. Time saved on loading the holes and on other operations means extra profits for you.

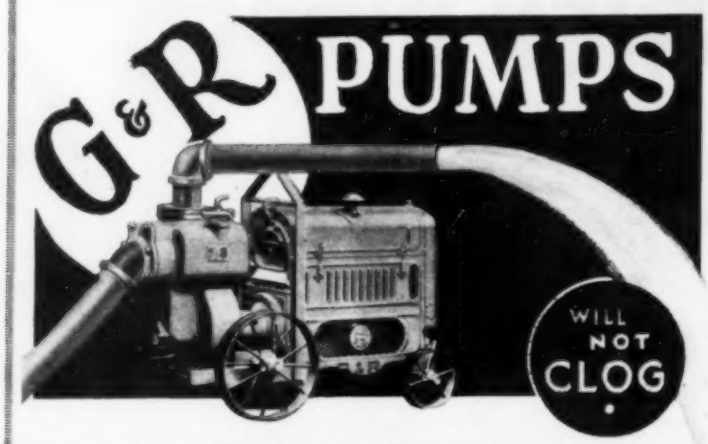
Write for a copy of the Cordeau Book, available without charge.

MAKERS OF ENSIGN-BICKFORD SAFETY FUSE SINCE 1836

CORDEAU-BICKFORD
Detonating Fuse
The ENSIGN-BICKFORD CO.
Simsbury, Conn.

CB67

G & R PUMPS



Claims **of fastest priming, highest suction lift, more gallons per minute, etc., *do not pump water.* On the job, the pump must do its own talking, and with dirty water, many a pump is inclined to stutter—and stop.**

Let G & R Pumps tell you their own story on any job. They will deliver as much, and usually more, water *under any condition,* than any other pump. We will ship you one and let you be the judge.

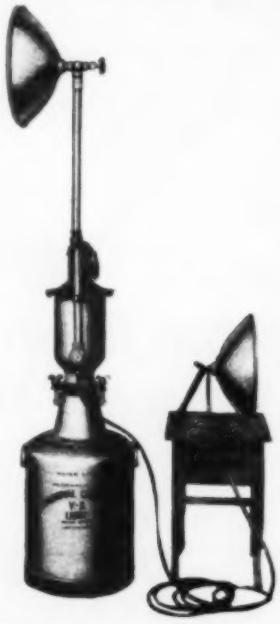
Remember this about G & R Pumps — THEY WILL NOT CLOG — THEY ASK NO TIME OUT. Play safe! Try a G & R Self-priming Centrifugal before you buy any pump this year.

Distributors in 100 principal cities are ready to make prompt delivery of the G & R Pumps you need.

The Most DEPENDABLE Pump for The Least Money

THE GORMAN-RUPP CO. Mansfield, Ohio

NATIONAL CARBIDE



National Carbide V.G. Light. 8,000 Candle Power without extension; 16,000 Candle Power using extension. Easily handled by one man.

V-G LIGHTS

MORE LIGHT FOR LESS MONEY

Easily Handled
No Wires
No Carbide Wasted
No harm done if tipped over

Y 199 National Carbide V. G. Handy Light 1500 Candle Power Weighs only 37 pounds charged.

Write for COMPLETE INFORMATION

W11-C1 National Carbide Lantern. Brilliant rear signal of red blue or green. Ideal for emergencies

Use National Carbide in the Red Drum

NATIONAL CARBIDE CORP.
LINCOLN BUILDING NEW YORK

GMC *Announces* FOR 1938

- IMPROVED DUAL-TONE APPEARANCE
- GREATER DRIVER COMFORT AND CONVENIENCE
- BIGGEST STANDARD BODIES IN THE INDUSTRY
- MECHANICAL BETTERMENTS
- GMC PRICES STILL CROWDING THE LOWEST
- LOWEST PRICES FOR STANDARD CAB-OVER-ENGINE MODELS

GMC offers for 1938 three new fast-duty models, a new ¾-ton, a new 1-ton—and a stalwartly built 1¼-ton model. GMC introduces a long list of mechanical betterments, notably improving its extensive line. GMC unveils a new stream-style dress, a still finer evolution of its already famous "Dual-Tone" design. And GMC offers all models ½ to 12 tons *at prices that are still crowding the lowest!* See these trucks—see your GMC dealer.

THE TRUCK OF VALUE GMC

Three NEW MODELS *and a* FULL LINE ½ TO 12 TONS

Built to shoulder loads not practical for lighter trucks, GMC's new ¾-ton, new 1-ton, and new 1¼-ton models are stoutly framed, amply powered, and equipped with the biggest standard bodies (panel, pick-up and stake) that trucks in this class afford! GMC now offers longer-life trucks in the "light heavy-weight" class—sized for every specific haulage requirement—and all with GMC traditional high quality—all priced down near the lowest!

new 3/4-TON

new 1-TON

new 1¼-TON

GENERAL MOTORS TRUCKS & TRAILERS

The JACKSON "HYDRO-SPADE"

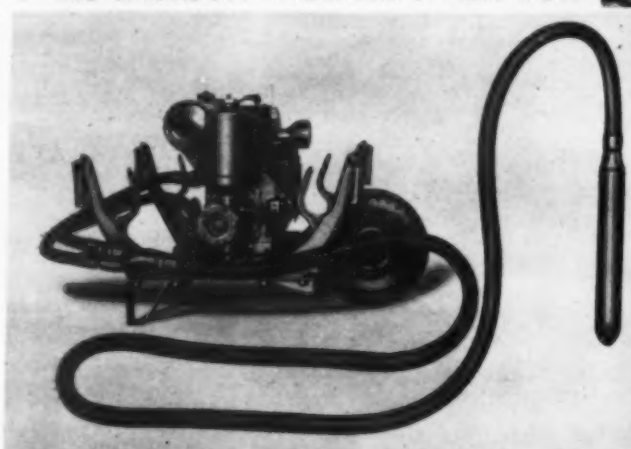
A Radical Innovation in Hydraulic Motor Design makes this

JACKSON CONCRETE VIBRATOR

Ideal for all General Construction . . . Utterly Simple
Absolutely Dependable

A Small Diameter Internal Vibrator of correct frequency and smooth amplitude for speedy placement and uniform transformation of stiff mixes into plastic, easily workable concrete. . . . The JACKSON HYDRAULIC VIBRATOR is ruggedly constructed of finest materials throughout for maximum performance and lowest upkeep under severest service conditions.

YOU CAN FORGET VIBRATOR LUBRICATION . . . All parts operate in the hydraulic medium — a high grade lubricating oil.



Get A Jackson And Be Sure

Ask for folder C-HYD

ELECTRIC TAMPER & EQUIPMENT CO.
LUDINGTON, MICHIGAN
MANUFACTURERS OF VIBRATORY EQUIPMENT FOR 17 YEARS

BAKER

DIRECT LIFT—HYDRAULIC
BULLDOZERS

There is no doubt in the minds of the many users of Baker Bulldozers that direct lift combined with easy control and simple, rugged construction solves their bulldozing problems. Fewer parts to wear — no loose joints — simplicity in every detail of construction and operation — these are features that are putting more Bakers on more jobs. It's real economy to use Baker Bulldozers and Gradebuilders.

See our big exhibit at
ROAD SHOW
CLEVELAND
Jan. 17th to 21st
BULLDOZERS, GRADEBUILDERS, ROOTERS, MAINTAINERS, SCRAPERS, SNOW PLOWS

Ask for Bulletins on
BULLDOZERS
and other Baker Products.
THE BAKER MFG. CO.
568 Stanford Ave.
SPRINGFIELD, ILL.

HAISS Hi-power

"...THE BEST DIGGING BUCKET YOU'VE EVER USED"

We're not using our words — but are quoting the blunt opinion of a hard driving contractor. He knows what self-cleaning lower sheaves gain in closing effort, and save in rope wear. You'll be equally sure WHEN YOU'VE LOOKED INTO BULLETIN 237. Ask us to send you a copy.

Represented in all Principal Cities

GEORGE HAISS MFG. CO., INC.
139th St. & Canal Pl., New York
ASK FOR BULLETIN 237 ON FAMOUS HI-POWER CLAMSHELL BUCKETS

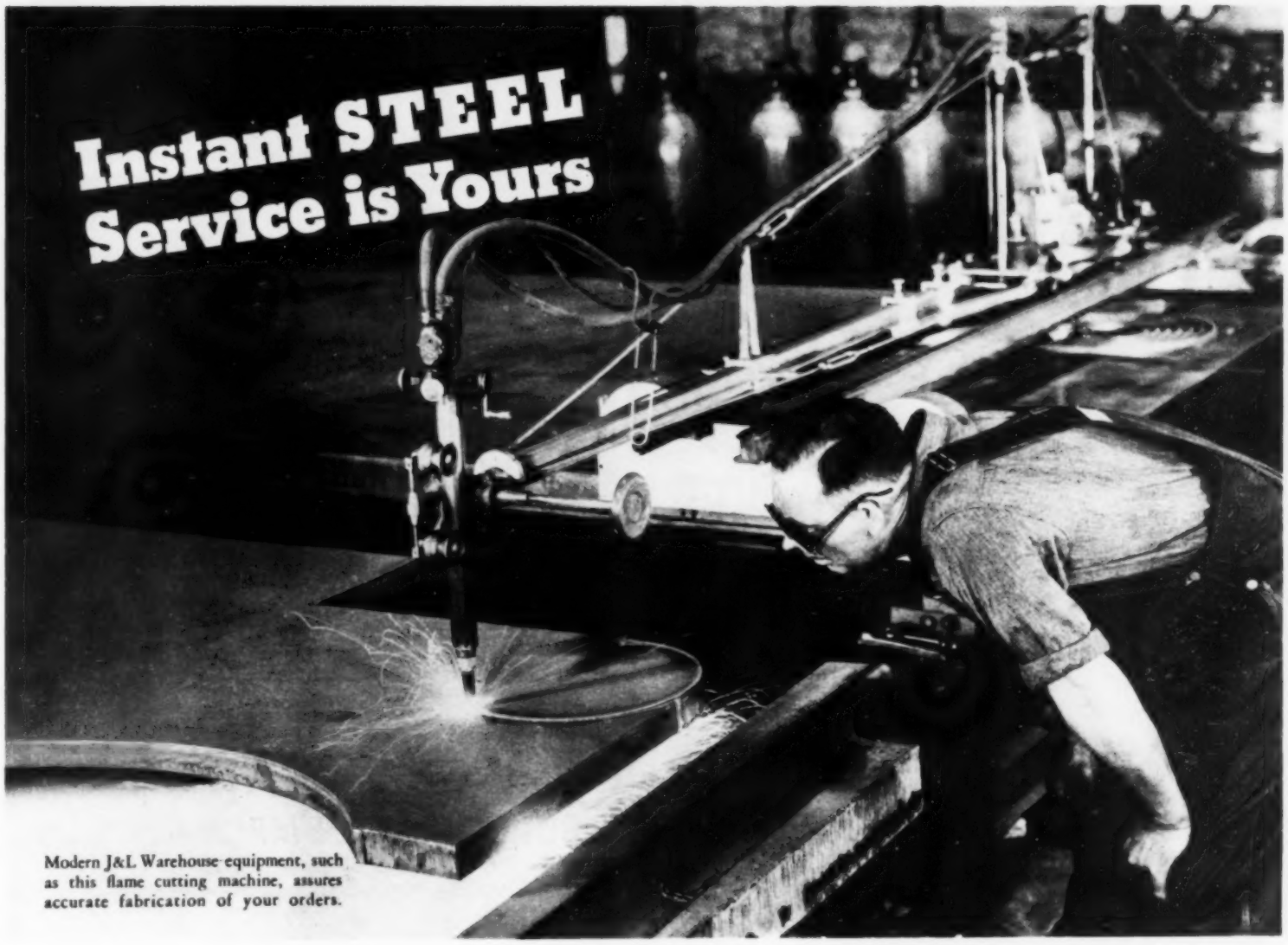
ARE YOU

One of Our Complaining Readers?

In these pages of our August and October issues we listed a total of 90 items of literature describing new or redesigned products of interest to engineers and contractors. Our reader response was so great that we had to add business machines and clerical help but while this was being done hundreds and hundreds of requests piled up. The resultant delay in getting requests for something like 6,500 pieces of literature to manufacturers quite naturally irritated some of our good readers who were impatient to get the new literature. We have written them letters of explanation.

This is a reflection on our office efficiency but it is also a reflection on those manufacturers who are not capitalizing the use that engineers and contractors make of **Construction Methods & Equipment's** advertising pages.

• ● •



Modern J&L Warehouse equipment, such as this flame cutting machine, assures accurate fabrication of your orders.

. . . from your J&L WAREHOUSE

INCREASE YOUR PROFITS WITH J&L STEEL

When time means money to you . . . when emergency needs call for steel products in *ready-for-use form* . . . rely on your Jones & Laughlin Warehouse. Many alert contractors know from profitable experience that J & L warehouse service saves many costly delays . . . is the most dependable answer to their emergency needs for steel.

J & L Warehouses are conveniently located. They carry complete and diversified stocks of high-quality steel products . . . and are fully equipped for cutting, bending, forming, welding and fabricating steel. Jones & Laughlin Warehouses will meet your *exact* requirements for strength, safety and service.

A staff of competent engineers and designers, equipment for special emergency work, and adequate delivery facilities mean that you get the steel you need . . . in ready-for-use form . . . *on time.*

Rely on Jones & Laughlin for emergency steel service. You will find that your work will move steadily forward . . . that you save time and money. Buy your steel from J & L Warehouses.

JONES & LAUGHLIN STEEL CORPORATION · PITTSBURGH

MAKERS OF HIGH QUALITY IRON AND STEEL PRODUCTS SINCE 1850

J&L WAREHOUSES

PITTSBURGH	CINCINNATI	DETROIT	NEW ORLEANS	CHICAGO
26th and Jane Sts. Hemlock 1000	5th and Vine Sts. Main 2324	3289 Beaufait Ave. Plaza 0470	North Miro and Japonica Sts. Franklin 1131	2250 W. 47th St. Virginia 1600

NEW YORK, 30-44 Review Ave., Long Island City . . . New York City, Ironsides 6-8700 . . . Jersey City, Bergen 4-2994 . . . Newark, Market 3-2994
Operated by Jones & Laughlin Steel Service, Inc., formerly National Bridge Works

MEMPHIS, 1 Auction Ave.—5-1625 . . . Distributing Warehouse for Pipe, Sheets, Spikes and Wire Products. Reinforcing Bar Warehouse and Fabricating Shop

FOR EVERY NEED . . . THE RIGHT QUALITY OF STEEL IN A FULL RANGE OF SIZES

JUST PRESS THE BUTTON

FOR INSTANT AIR POWER

SCHRAMM 105 DeLuxe "Utility" Compressor. Insert showing instrument panel with gauges and starting button.

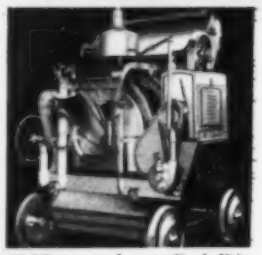
WINTER STARTING HAS ITS PROBLEMS! Think what it will mean to start your compressors as quickly, easily, safely as you do your automobile. Think of the time saved, the safety to workmen and the saving in wear on your compressor. SCHRAMM "Utility" Compressors give you built-in electric starting on every size and model. No extra cost. Just push the button — SCHRAMM "UTILITY" STARTS!

Write for SCHRAMM Bulletin 3700-CJ.
SCHRAMM INC., West Chester, Penna.

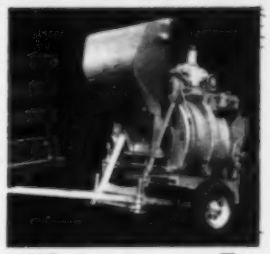
SCHRAMM

AIR COMPRESSORS

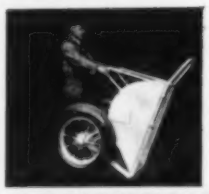
→ PROFIT MAKERS
NEW CMC MIXERS



CMC 7s and 10s End Discharge Models. New—compact—fast. The advantages of a speedy trailer with four wheel stability.



CMC 8s — 7s — 10s Two Wheelers. The fastest moving — fastest working one and two bag Mixers ever developed.



GET THOSE JOBS DONE IN A HURRY!

Don't take chances with old, worn-out equipment. See the new, fast, completely modernized CMC line of Mixers — all sizes—Wonder Tilters, Dumpover Pneumatic Tired Carts (See Illustrations), Hoists, Pumps, Saw Rigs, Wheelbarrows.

Write Today For Latest Catalog.

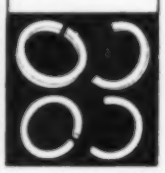
CONSTRUCTION MACHINERY CO.
WATERLOO, IOWA

SPRING WASHERS

Spring washers and lock washers of every type and size, including the well-known Hipower and Kantlink types. There are thousands of more places where spring washers would improve the value of any product where bolts, nuts, cap or machine screws are used.

STEEL ROD ENDS

Drop forgings including steel rod ends of the adjustable yoke, plain yoke, and eye types. These articles in standard sizes and threads afford tremendous savings over special designs.

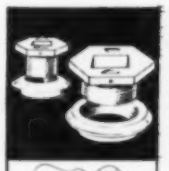


RETAINING RINGS

Spring retaining rings of special heat-treated spring steel are carried in many stock sizes—both open and closed types. Use of a spring retaining ring is an excellent manner of creating a shoulder on a shaft.

STEEL BARREL CLOSURES

Forged and machined fittings for steel barrels, drums, tanks and metal packages, including plugs, rings and flanges. Very rugged for use in transportation of alcohol, turpentine, oils and other expensive liquids.



CONTAINER HANDLES

Forged steel handles for heavy containers—can be rigidly welded, riveted or attached by a strap to lie flat when not in use. Rugged and most satisfactory for hard usage.

RHEOSTATS—RESISTORS—LOAD BOXES AND SPECIAL APPARATUS

Our electrical division—Hardwick, Hindle, Inc.—makes as fine electrical resistance products, fixed and variable, as can be devised.

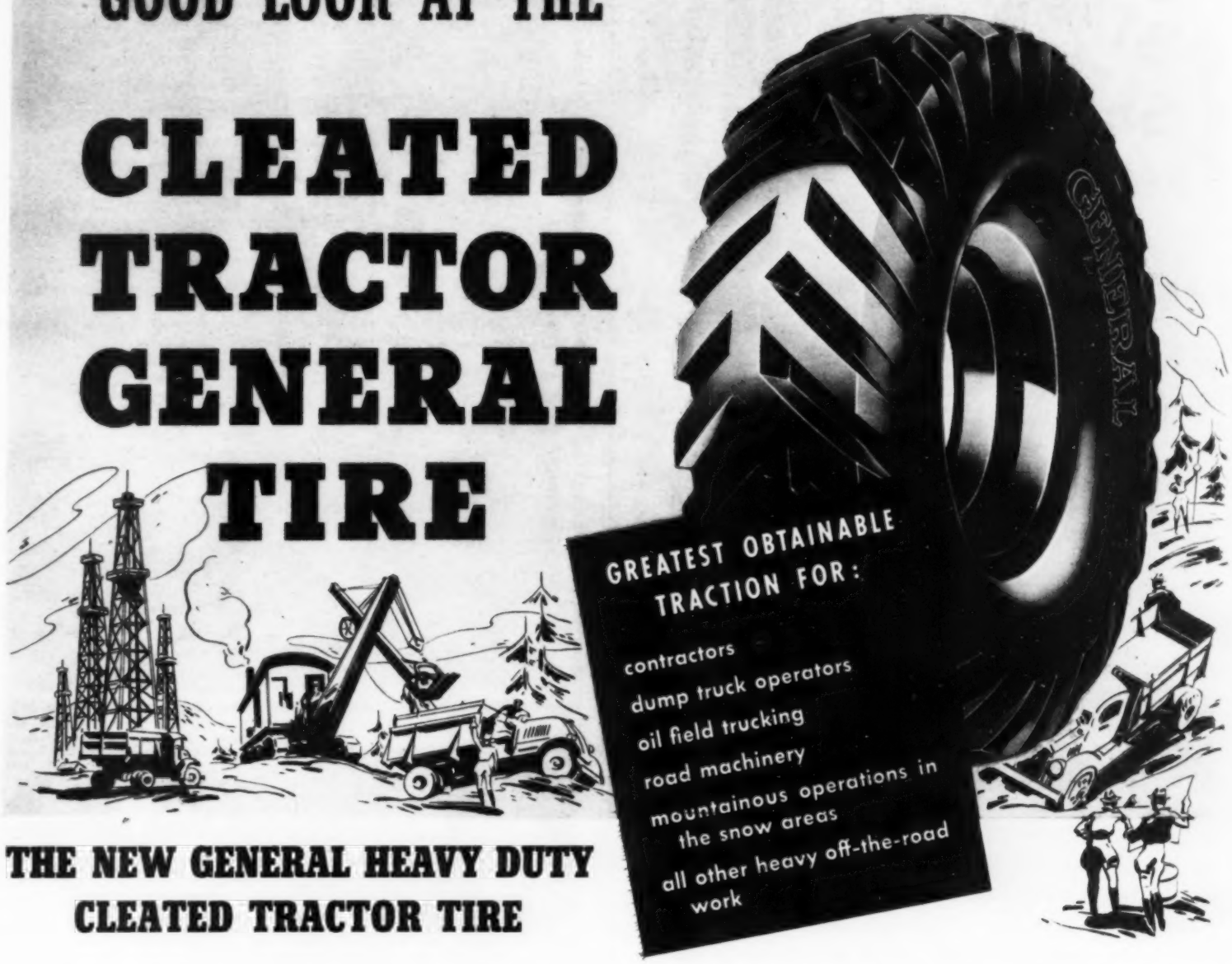
• • • • • •

Other products include windows for buses and railway cars, railway car window curtains, curtain rollers and fixtures, sash locks and lifts.

THE NATIONAL LOCK WASHER COMPANY
NEWARK, N.J. – EXPORT DIV., 15 E. 26 St., N.Y.C.

NOW IS THE TIME OF YEAR TO TAKE A GOOD LOOK AT THE

CLEATED TRACTOR GENERAL TIRE



THE NEW GENERAL HEAVY DUTY CLEATED TRACTOR TIRE

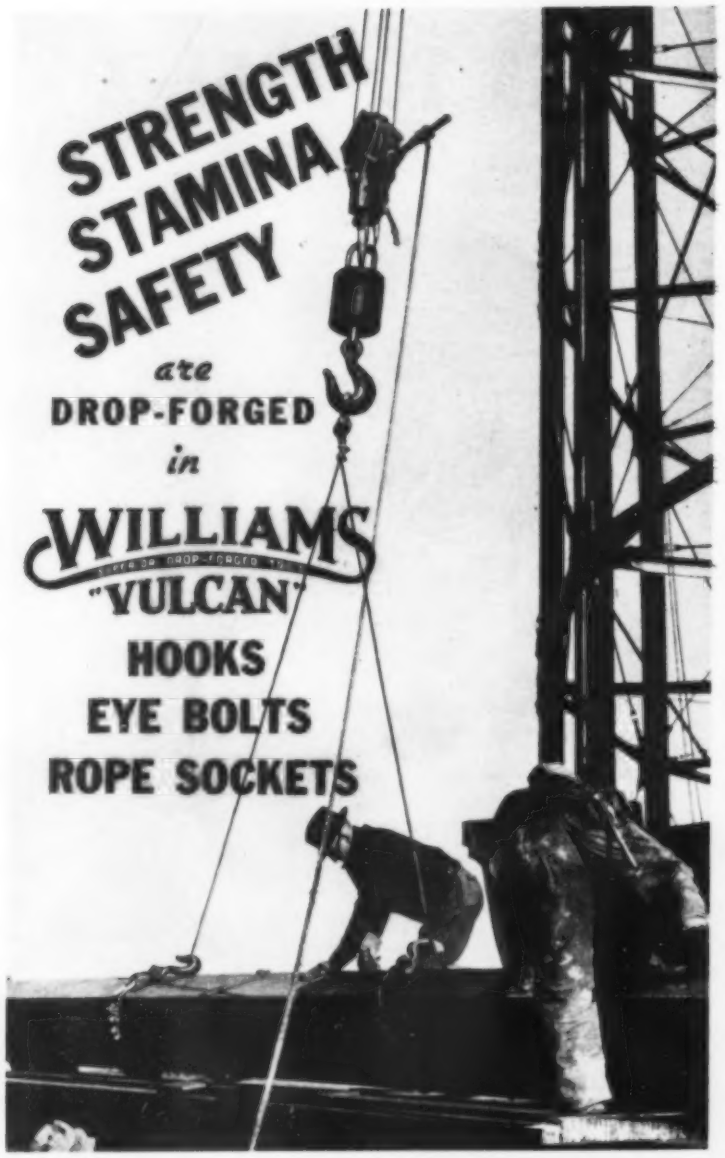
1. Thick, heavily cleated tread is practically slip-proof in soft going.
2. Tread is self-cleaning in mud and sand.
3. Center riding rib, for smooth rolling and slow wear when running on hard surfaced roads.
4. General's famed quality construction, and two extra plies running from bead to bead make it the *strongest* truck tire of its type you can buy.
5. Cooler running due to patented *no-breaker-strip construction.*
6. Heavy dual and triple-cable beads.

Many truck operators, at this time of year, are interested especially in *traction.* General suggests that those operators take a good look at the new Cleated Tractor General. It has been designed and built to deliver the greatest possible traction and performance on those jobs for which it is suited.

But General further suggests that before buying any type of tire operators get in touch with the local General Tire dealer. He has a complete, specialized line of truck tires. He is a practical truck tire man with wide experience in recommending and applying the *right* tire for every operation. He can save you money. Call him in.

THE GENERAL TIRE & RUBBER COMPANY · AKRON, O.
In Canada, The General Tire and Rubber Co. of Canada, Limited, Toronto, Ontario

GENERAL
TRUCK TIRES



Every Williams' "Vulcan" Hoist Hook and Eye Bolt is *proof-tested to 50% beyond* its rated "safe-working load." For safety sake, insist that your Hooks carry this assurance of strength and dependability. You can identify "Vulcan" Hooks by the orange tip. Buy from your industrial supply distributor.

"VULCAN" ROPE SOCKETS; drop-forged, weldless—Open and Closed, for ¼ to 1⅜" wire rope.

"VULCAN" HOIST HOOKS; Shank and Eye patterns — ½ to 25 tons.

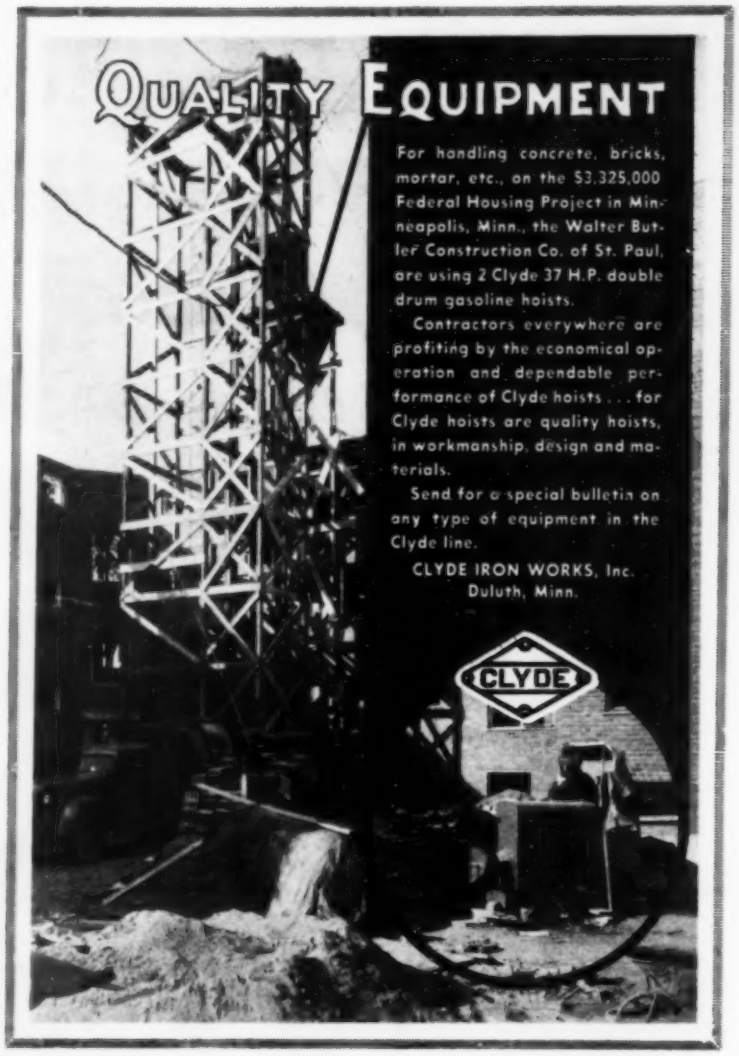
"VULCAN" EYE BOLTS; Plain and Shoulder patterns — shanks blank or threaded — 1/5 to 16 tons.

J. H. WILLIAMS & CO.

75 Spring St., New York

Headquarters for: Drop-Forged Wrenches (Carbon and Alloy), Detachable Socket Wrenches, Reversible Ratchet Wrenches, "C" Clamps, Lathe Dogs, Tool Holders, Eye Bolts, Hoist Hooks, Thumb Nuts and Screws, Chain Pipe Tongs and Vises, etc., etc.

WILLIAMS
SUPERIOR DROP-FORGED TOOLS



You Can Bet Your Life on LAUGHLIN DROP FORGINGS

LAUGHLIN Wire Rope and Chain Fittings are thoroughly dependable, accurately sized and cleanly finished.

Over 70 years experience and the facilities of a modern plant combine in placing at your service, industrial hardware of outstanding merit.

Send for catalog showing the complete line.

LAUGHLIN Pear Shape Missing Link (Patented)

LAUGHLIN Eye Hoist Hooks

LAUGHLIN Wire Rope Sockets, Open Pattern

LAUGHLIN Round Pin Shackles

THE THOMAS LAUGHLIN COMPANY
Portland, Maine

Manufacturers of Industrial and Marine Hardware Since 1866

New York · Chicago · Detroit · New Orleans
Los Angeles · San Francisco · Seattle · Denver

It's simple and costs nothing to keep in touch with new equipment and materials of construction this way

Here are some of the items of new construction equipment, materials and supplies that manufacturers have called to our attention. In many cases new literature describing the items is available. In those cases where literature is not mentioned the manufacturers will be glad to send details in a special letter if literature is not off the press in the meantime. In some instances the new literature is a consolidation of bulletins, circulars, etc., describing specific products, making available in one folio descriptions of the manufacturer's complete line.

Readers are asked to indicate on the postage-paid card below only those items in which they are interested in connection with their present work or contemplated new jobs. Please follow instructions carefully, write clearly and give your complete address. If you move to new work before the requested literature arrives please notify this department or leave your forwarding address with the postmaster. A number of catalogs and bulletins have been returned to manufacturers because our readers moved and left no forwarding instructions.

READERS' SERVICE DEPARTMENT
Construction Methods & Equipment

WEIGHING HOPPERS

91. **Bulletin 150-D, Butler Bin Co.** A 16-page booklet illustrating and describing portable bulk cement plants, batchers and weighing hoppers.

BUILT-UP WELDED CONSTRUCTION

92. **Booklet, L. O. Koven & Bro., Inc.** Presents cases where Koven built-up welded construction has been successfully used.

NEW TYPE PUMP

93. **Robbins & Myers, Inc.** Ask for complete details about the Moyno pump with the curious rotor. Claimed to handle solids in suspension, such as sand and water in the ratio of 1:4, and practically anything that will flow in a pipe. Capacities up to 175 g.p.m.

SMALL DIESEL CRAWLER

94. **Folder, The Cleveland Tractor Company.** Model AD, with 28 h.p. at the drawbar, is described as the first small diesel crawler.

REAR DRIVING UNIT

95. **Folder, James Cunningham, Son & Co.** Describes universal half track unit for application to standard makes of 1½ and 2-ton trucks.

ICE CONTROL

96. **Booklet, International Salt Co., Inc.** Carries 18 pages of tables, illustrations and general information under title, "Make icy pavements safe with rock salt."

TEST BORING TOOLS

97. **Bulletin 20, Acker Drill Co.** Briefly describes line of earth augers and samplers, core drills and accessories.

THIRD AXLE

98. **Folder, Truck Equipment Co., Inc.** Illustrates and describes applications of Truxmore third axle for increasing pay load of trucks.

AUTOMATIC VALVES

99. **Catalog 37, Ross Valve Mfg. Co., Inc.** A 72-page book reviewing the company's line of automatic control and pressure regulating valves, hydraulic booster pumps, etc.

HYDRANTS

100. **Bulletin K, Rensselaer Valve Co.** This pamphlet briefly describes the features of Corey hydrants and Rensselaer valves and tapping sleeves.

SPIRAL WELDED PIPE

101. **Bulletin 136, The American Rolling Mill Company.** A spiral-bound, 2-color booklet of 48 pages, with data, photographs and complete description of spiral welded pipe for water service.

MAINTENANCE PAINTS

102. **Loose leaf booklet, The Debevoise Company.** A manual of exterior and interior painting of structures of all types, and machinery and equipment outdoors and indoors. 8 pages of color samples.

PHOTOGRAPHIC COPYING

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104. **Hardbound book, Buff & Buff Mfg. Co.** Complete catalog of Buff surveying instruments together with price list, testimonials of users. 146 pages.

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113. **Booklet, Chicago Pneumatic Tool Co.** Sixteen pages of types and specifications of "Power Vane" drills, screw drivers, nut runners, grinders, woodborers, wrenches, concrete surfacers, shimmy spades and sump pumps.

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LETTERING SETS

118. **Booklet, Keuffel & Esser Co.** Describes Leroy lettering sets for simplifying the draftsman's job of lettering drawings.

TRACTORS

119. **Booklet, The Linn Manufacturing Corp.** A 20-page presentation of the Linn line of gas and diesel tractors (dump body types) for snow removal, general hauling, logging, earth moving and mining.

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120. **Two booklets, Koh-I-Noor Pencil Co., Inc.** One booklet, "The Pencil Since 1565," gives the history, manufacture and use of the pencil. The other booklet illustrates the complete Koh-I-Noor line of pencils, brushes, leads, pens, etc.

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123. **Four folders, Southwest Welding & Mfg. Co., Inc.** These 4-page sheets illustrate and describe the Southwest tamping roller, carry scraper, and road ripper.

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124. **Bulletin 762, Chicago Pneumatic Tool Company.** An 8-page description of the WO-2 portable compressor, the W-CO stationary compressor and the CP aftercooler.

WIRE ROPE

125. **Manual, Wickwire Spencer Steel Co.** "Know Your Ropes" is a booklet designed to help select the right type and size of Wisscolay preformed wire rope.

ARC WELDING

126. **Bulletin 412, The Lincoln Electric Co.** "The new arc welding technique" gives details about the new "shield-arc SAE" welder.

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127. **Handbook, M. B. Skinner Co.** For engineers, superintendents and men responsible for pipe-line maintenance. Discusses leaks such as holes, splits, pitted and corroded sections. 12 pages.

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128. **Booklet, Electric Storage Battery Co.** Outlines problems of diesel starting and describes methods employed in Exide research laboratories for collecting data to be used in designing batteries for this kind of work. 15 pages.

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129. **Booklet, SKF Steels, Inc.** Pointers for distributors and users of rock drill steel. 44 pages with numerous photographs showing various steps in manufacture. Tables give dimensions, sections and weights of hollow and solid drill steel. Instructions for forging, heat treating and testing.

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132. **Catalog 65, The Stanley Works.** Describes and illustrates complete line of portable electric drills, grinders, hammers, sanders, saws, screw drivers, etc. Also contains price list.

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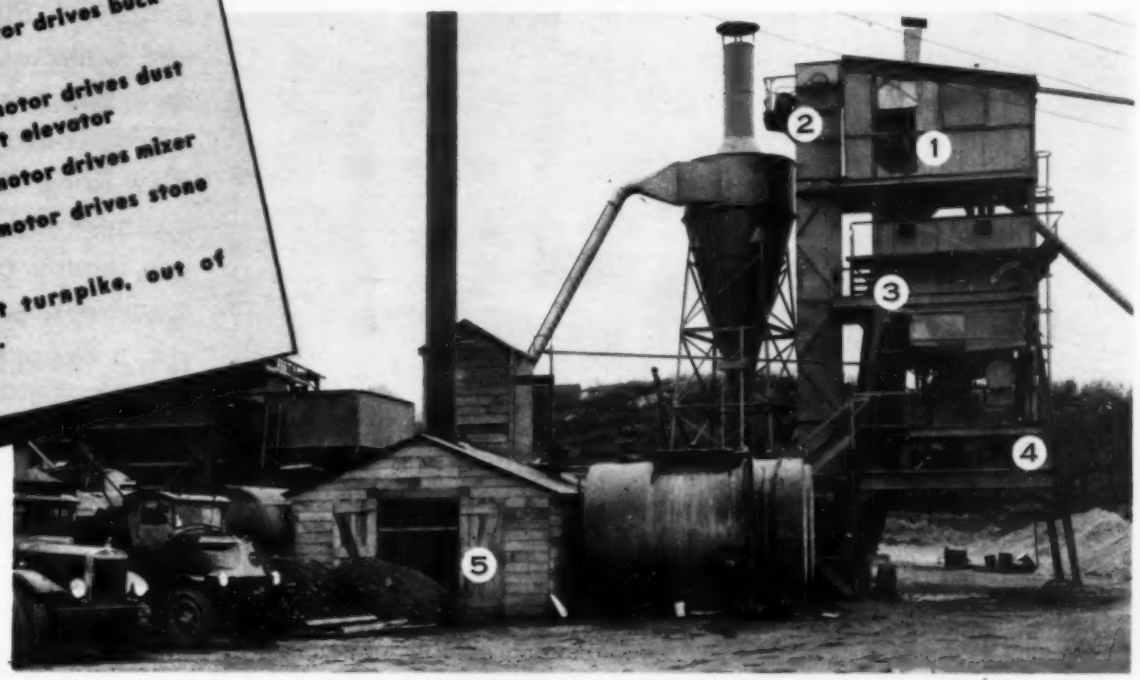

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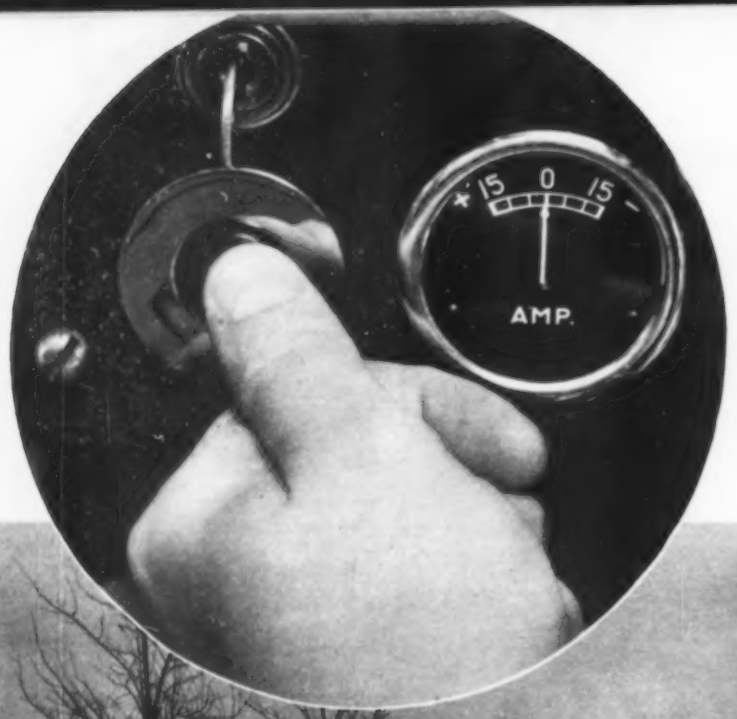

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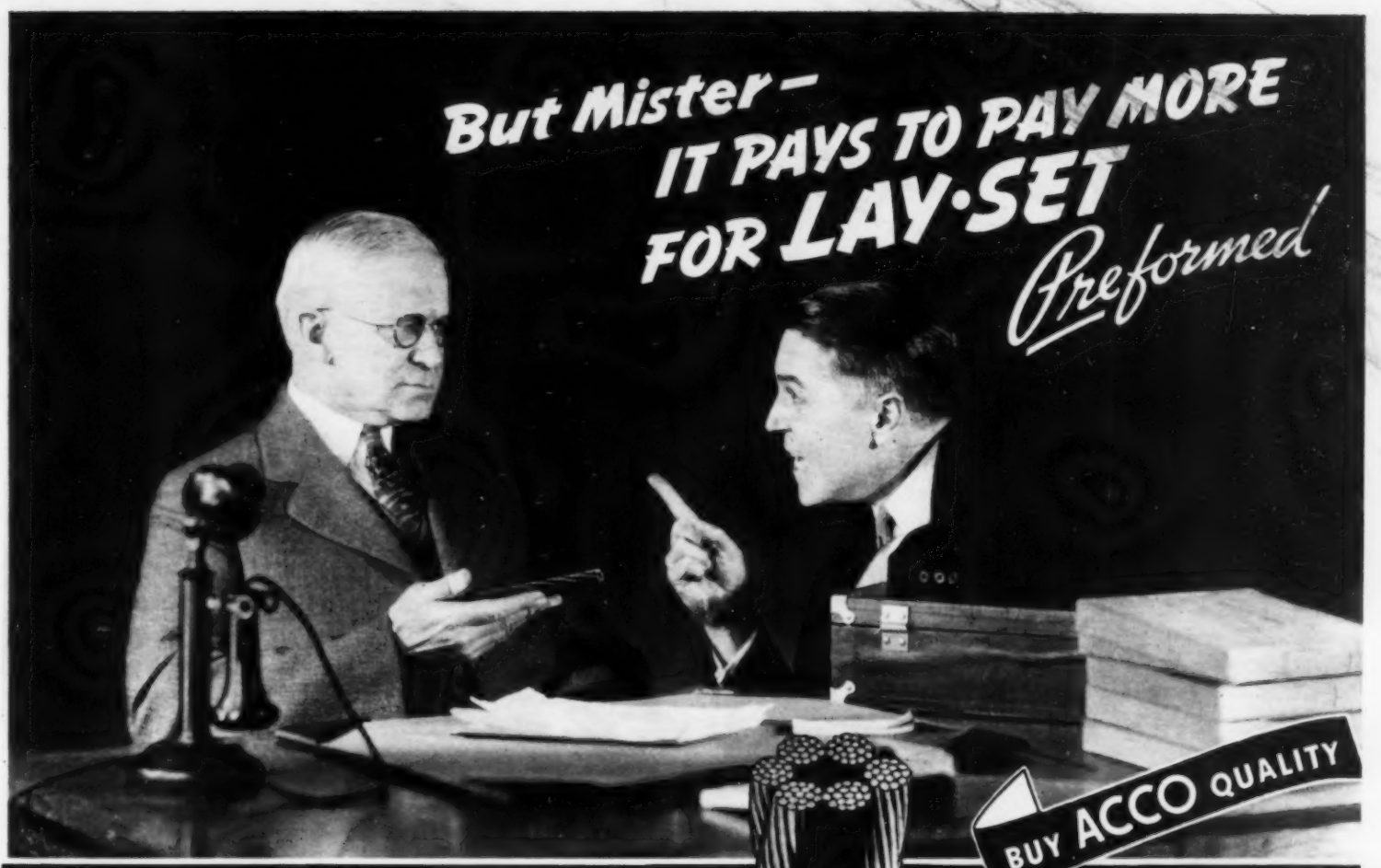

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